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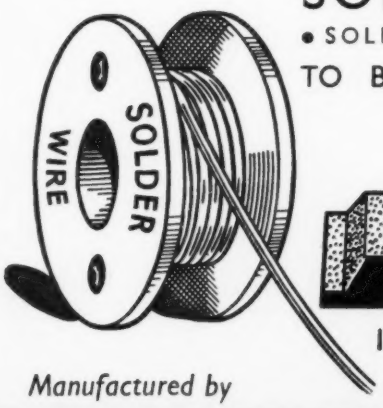

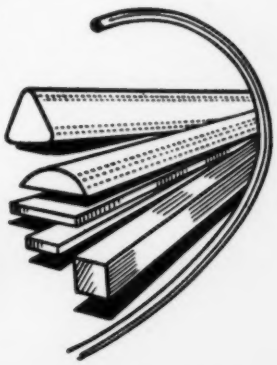

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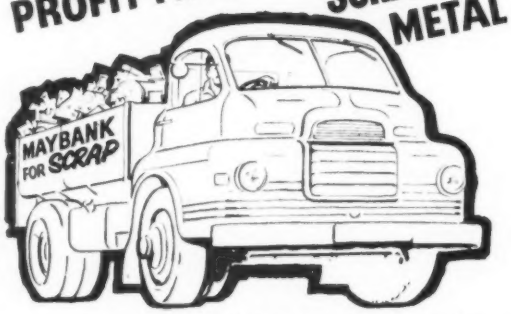

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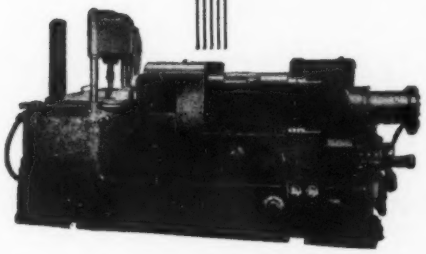

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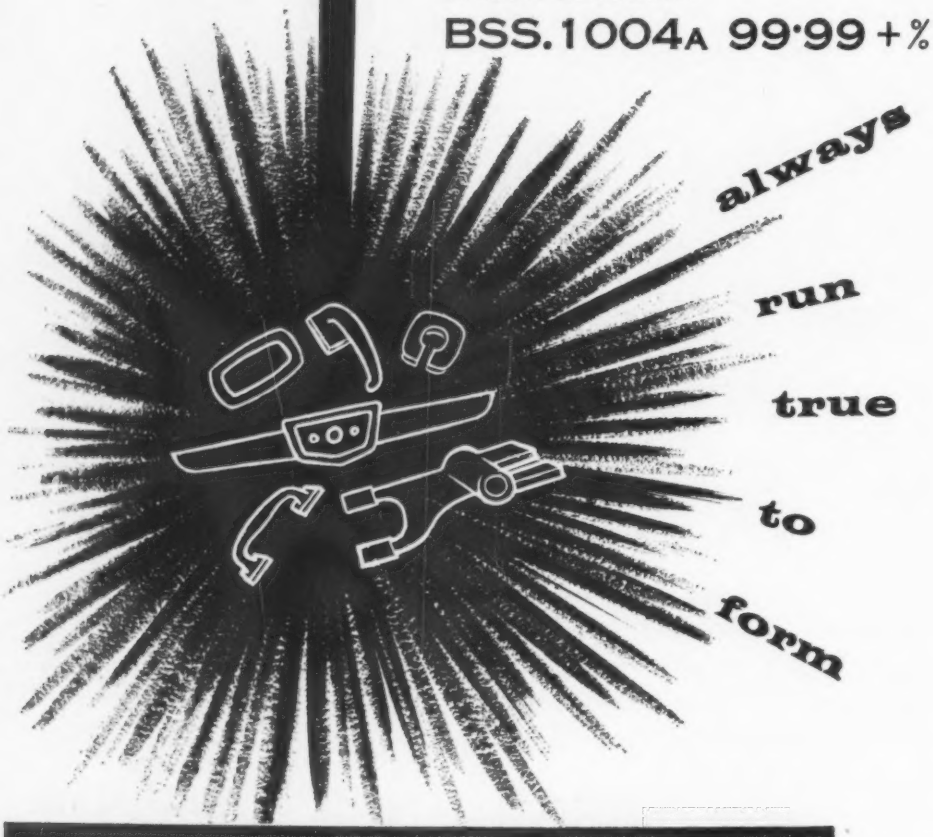

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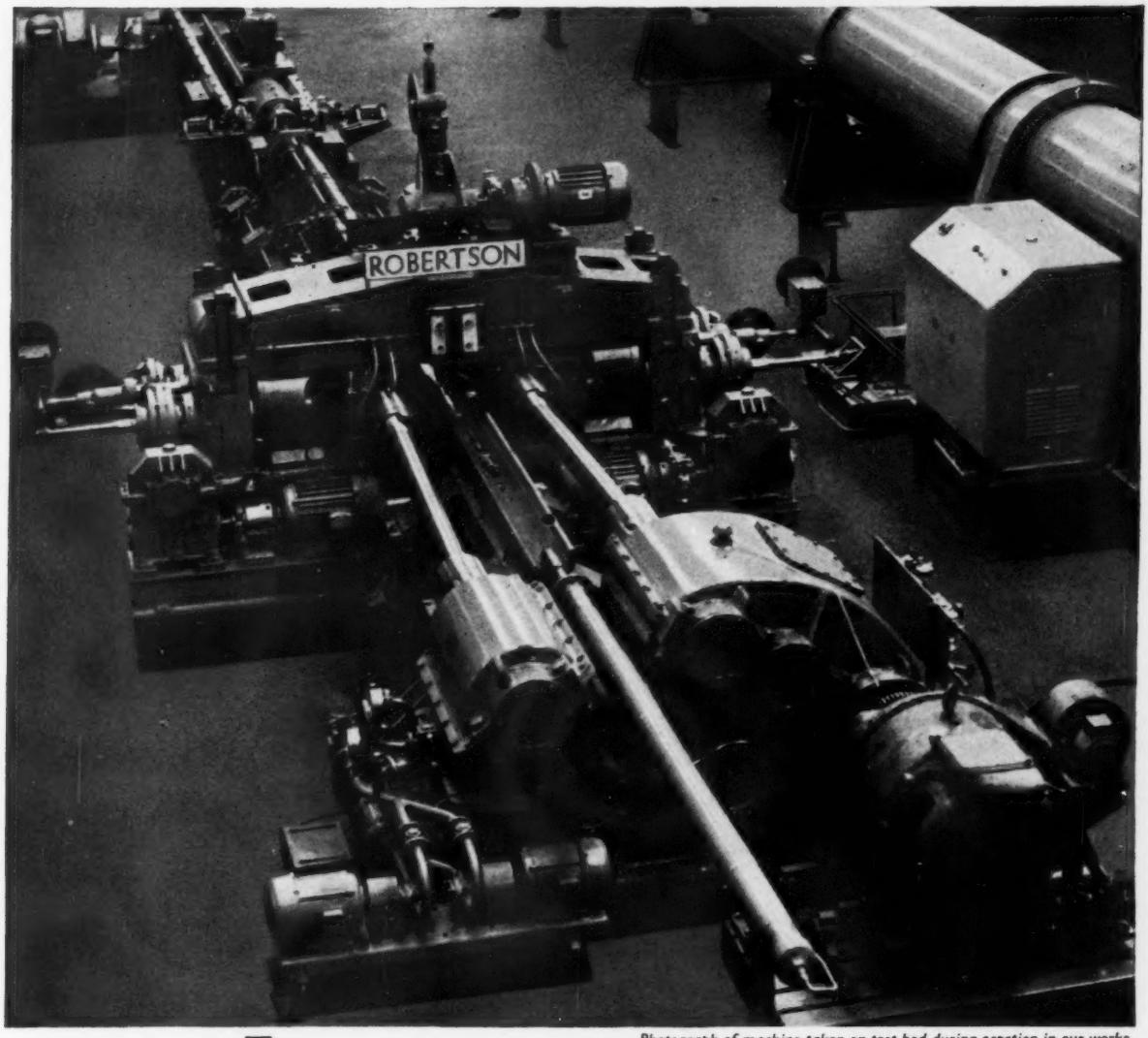

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METAL INDUSTRY

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28 July 1961 Volume 99 Number 4

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Mineral Processing

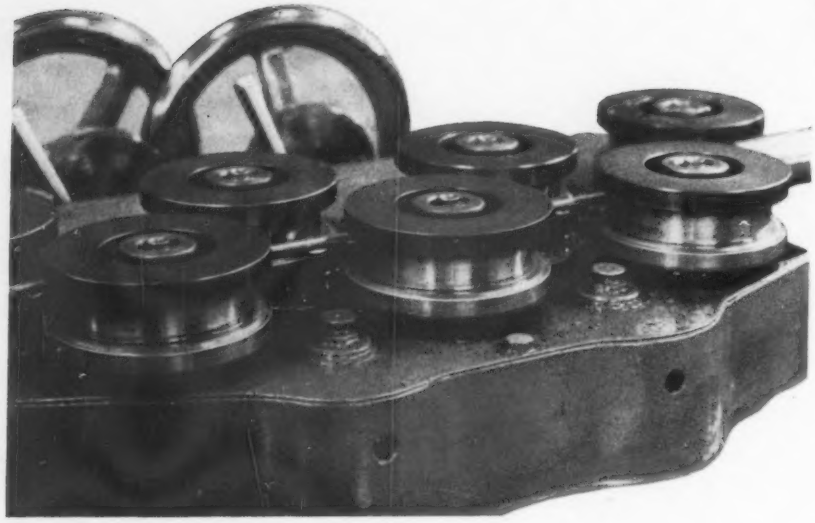
ONLY by the adoption of a modern research approach can adequate future mineral supplies be ensured. The improvement of existing processes and the discovery of new ones can mean the difference betwen abundance and scarcity of basic raw materials in the years ahead. Although we in this country are not at the present time directly concerned with the processing of native non-ferrous ores to any major extent, it is quite within the realms of possibility that the discovery of a new method of treatment would enable indigenous ores to be utilized economically. We might then, for instance, see once again a prosperous tin mining industry in Cornwall, and even perhaps reverse the trend toward ever-increasing imports of non-ferrous metals. What is needed is an open mind receptive to new ideas, not hidebound to traditional methods.

The traditional procedure for determining the best method for processing ores has been to subject them to methods most successfully used with similar ores in the past. Today, research more frequently seeks answers to questions such as these: In what physical or chemical properties or reactions do the materials to be separated differ? How can these differences be used to effect an economical separation? This type of approach has already resulted in such basically new commercial processes as the concentration of uranium ore by utilizing the radioactivity of the ore for control purposes, and the extraction of nickel, copper and cobalt from flotation concentrates by leaching under heat and pressure.

With the rapidly expanding scope of science and technology it is becoming increasingly probable that any new basic information or tool needed in mineral research may be available or readily obtainable in some other, perhaps seemingly unrelated, field. As examples, R. J. Brison, in the current *Battelle Technical Review*, cites the solvent-extraction and ion-exchange processes from chemistry and chemical engineering, the fluidized-bed reactor from the petroleum industry, the use of radioactivity from nuclear technology, the bacterial leaching of ores from microbiology, and the possible application of the high-temperature plasma state which was originally of interest mainly to astrophysicists.

Although major advances in regard to automation are currently being made in the minerals processing industry, work is still required on the application and adaptation of present control equipment to mineral processing, and particularly in the study of control of the mineral processing plant as a unified system. Development of new equipment and control techniques, and the achievement of a more basic understanding of mineral-processing operations are also needed. Modification of existing processes and development of new processes more suitable for automation are other fields which offer attractive possibilities for economic exploitation.

New Brass



INCREASED PRODUCTION AND WIRE AT UNITED

CONTINUALLY increasing demand for the company's products has made it necessary for United Non-Ferrous Metals Ltd. (formerly United Wire Works (Birmingham) Ltd.) to expand its Adderley Street works. Accordingly, when in 1953 the Britannia Tube Co.'s works were closed, this was acquired by United Non-Ferrous Metals Ltd. to consolidate a site already held, thus enabling the present expansion scheme to get under way. Many natural difficulties present in and accruing from the geological structure of the land had to be overcome, as had those difficulties caused by the wealth of canal arms and inlets in the area. In 1957, demolition of the old factory buildings began and an intensive period of site preparation was entered upon, involving pile driving, levelling, etc., the forerunner to the erection of the present modern buildings, two in number, which comprise this latest expansion to United Non-Ferrous Metals Ltd.

In the first building, constructed in the usual manner with steel columns and 14 in. brickwork, with a corrugated steel deck roof, are housed a casting shop and metal stores. The second—housing press shop, rod mill, stores and despatch warehouse—is unusual in that prestressed, precast reinforced concrete beams and columns are used throughout. The reasons for the use of this type of construction were twofold: first, large areas clear of upright columns are able to be created, and secondly, a special type of crane track—referred to later—could be used. Roofing of this building is carried out in a proprietary board constructed from compressed, treated, wood wool, employed because of its thermal insulating properties.

Even judged by modern standards the new casting shop is exceptional, housing as it does one of the most modern non-ferrous casting plants in the country. Every effort has been made to make working conditions as pleasant as possible, and the general air of cleanliness and light is in sharp contrast to the conditions with which one meets in the majority of such shops. Typical of the attention paid to cleanliness and comfort are the automatic devices controlling lighting and ventilation.

Raw materials are stored at the Adderley Street end of the new building, adjacent to the existing storage spaces in the older portion of the works. Here, full advantage has been taken of the mechanical handling equipment available, and extensive use is being made of bulk handling and palletization. This is well illustrated by the methods used to store brass swarf. Material is discharged from tipper lorries directly into a hopper, at the bottom of which is installed a rotary feed mechanism which pushes the swarf into the buckets of an elevator. It is then taken by this means to the top of two large storage bins, each of 150 tons capacity, where after automatic magnetting, it is distributed by a system of chutes and feed screws into either or both of the storage containers. The vee-shaped bottom of each of these is equipped with powerful rotary discharge screws, enabling material to be extracted at will.

The most important items of plant in the department are, of course, the melting units. One Ajax-Wyatt two-ton twin slot low frequency induction 600 kVA furnace is already installed, provision having been made for a second to go in as soon as production needs demand it. A 12,000 lb. Ajax-Wyatt single slot induction furnace, hitherto the standard melting unit in the works, has also been installed to fulfil the dual purpose of providing molten metal for priming the larger furnaces and also act as auxiliary billet producing capacity. A small gas-fired Morgan crucible furnace is similarly installed to provide priming metal for the small Ajax-Wyatt. Metal transfer from the priming furnaces is effected by means of a refractory lined metal ladle capable of holding a maximum of two tons of molten metal.

All the melting units are sited at the edge of a large casting pit some 90 ft. by 16 ft. In this are placed the billet moulds, which are of the water-cooled copper shell type, installed in a triple housing mounted on a motorized carriage and capable of movement, on rails, along the entire length of the casting pit. Three 8½ in. dia. billets, approximately 7 ft. 6 in. in length, are poured per melt, each weighing roughly 1,500 lb.

After pouring has taken place, the mould carriage is moved to the extraction point, the housing is rotated through an angle of 90°, the mould bottom seals are removed, and the billets are pushed clear of the moulds, gate first, by means of a two-ton pneumatic ram. They are received on to a small table and thence tipped into either of two metal cradles. An overhead crane of 15 tons capacity, supplied by Smith (Keighley) Ltd., capable of sweeping the entire shop, hoists the billets out of the casting pit on to prepared storage spaces, where they are held, pending analysis, and prior to transfer to the extrusion mill. For this purpose, an automatic telpher is

Rod Mill

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employed, supplied by Demag and erected by Acrow (Engineers) Ltd.

A continuous casting plant, designed by the company's own personnel and based on the Tin Research Institute design,[1] occupies the far end of the department. This is a three-stage unit —on the top section the melting furnaces are sited, in the second stage the extraction rolls and their associated driving equipment are installed, whilst the bottom stage is intended ultimately to accommodate suitable coilers.

The melting equipment consists of two Morgan gas-fired 600 lb. crucible furnaces, which pour by means of a launder directly into the 400 lb. holding furnace. The latter has been manufactured within the company's works to a Gas Board design, and is capable of maintaining a reservoir of molten metal at the correct casting temperature for long periods without adjustment or attention.

With the present extraction mechanism, the machine is capable of casting up to four rods of a maximum 1½ in. dia., or alternatively up to two strips of 6 in. maximum width. Casting is through graphite dies of conventional pattern cooled by individual water jackets and secondary sprays.

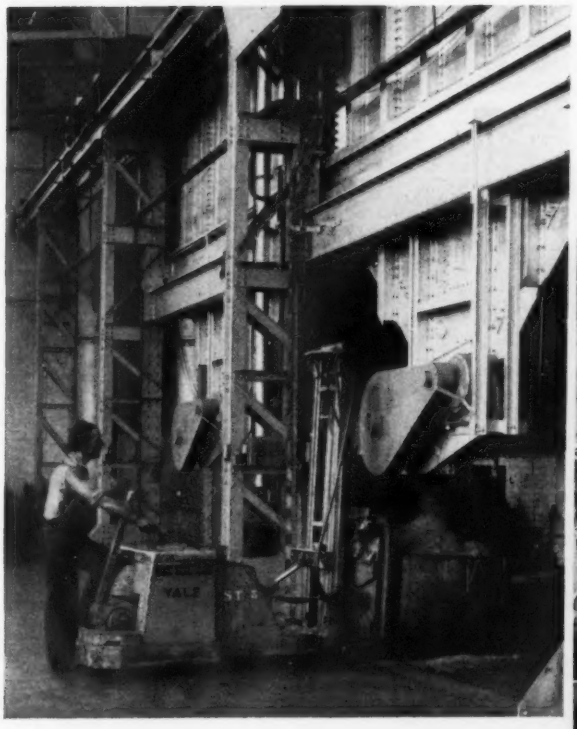
Small sections of the shop have been set aside for various auxiliary operations, furnace ramming, etc., and adequate provision has been made for the storage of necessary spares.

Extrusion Shop

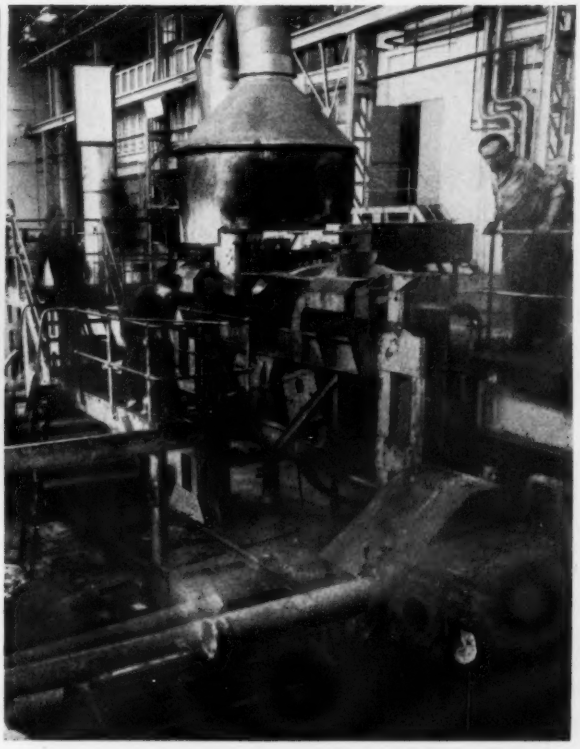
The fully mechanized extrusion press plant, designed and built by The Loewy Engineering Co. Ltd., consists basically of a 2,500-ton horizontal self-contained oil hydraulic extrusion press fed by six Loewy Magnethermic mains frequency induction billet heaters.

Billets are received from the casting shop via the overhead railway on to heavy gauge RSJ stock racks. From these they are fed on to a mechanized roller track which conveys them to the Russell Hydrofeed cold billet saw, where they are cut to predetermined lengths for extrusion. Hydraulic grips, inching devices and reversing feeds are features of this saw.

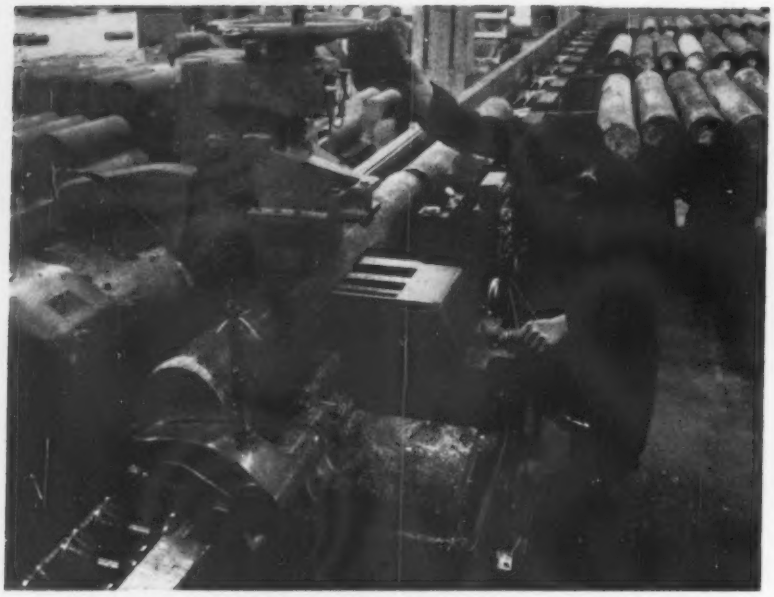
From the saw, the billets automatically transfer to a loading con-



Left: Discharging swarf from one of the two 150 ton hoppers. The tramp metal ejection chute can be seen behind the central stanchion. The hoppers are fed by a rotary screw which carries swarf via elevator buckets into either hopper



Right: Ajax-Wyatt 2-ton twin slot furnace with triple billet moulds in the foreground. Billets are poured in the vertical position, the mould is then moved to the ejection position, turned through 90°, and the billets pushed out by pneumatic ram after removal of the bottom mould seals



Billet saw. Behind the operator the cast billet store can be seen, with billets on the motorized track which feeds them to the saw. After sawing, billets go either to the billet stock or to the press

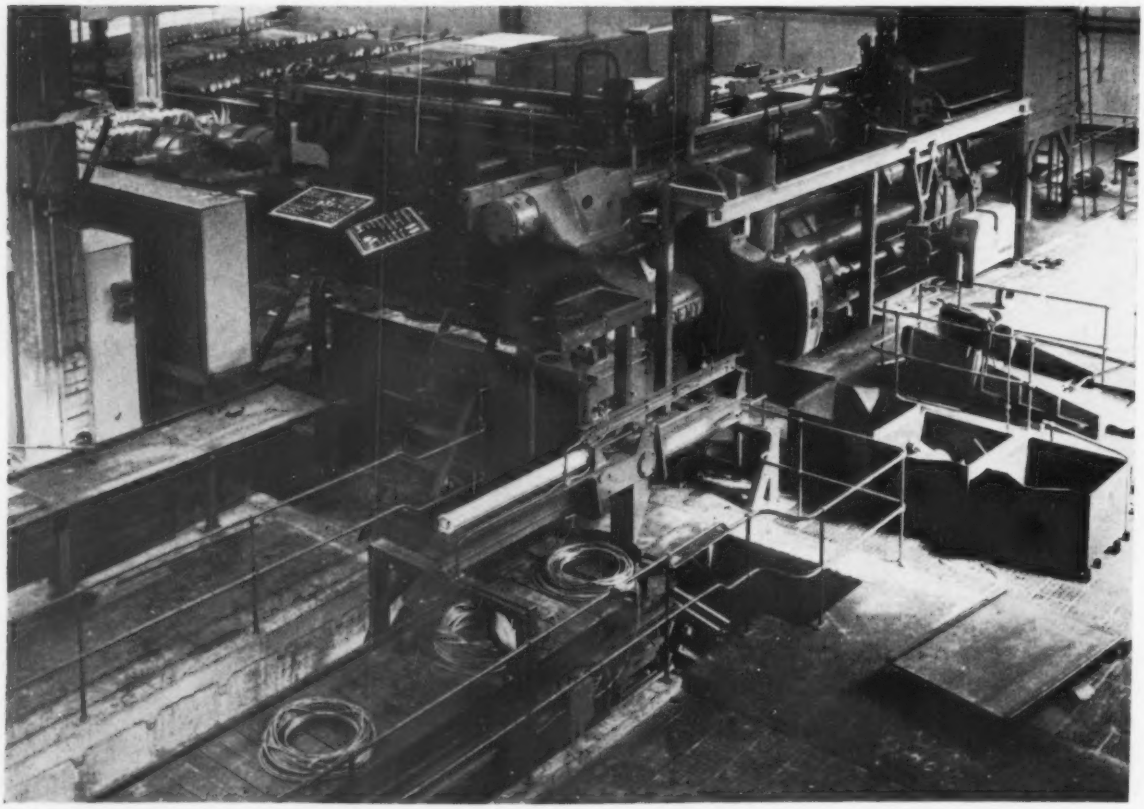
General view of 2,500 ton extrusion press. In the foreground is the coil conveyor for removal of extruded coil. The run-out table on the left is for rod, and in the background can be seen the cast billet stock

veyor, which then presents them to a heater loading position. The installation is so designed that, given an adequate supply of billets, it will automatically keep three in stock in front of all the heaters.

The six Loewy Magnethermic billet heaters have a maximum loading of 460 kW each and are equipped with Leeds and Northrup temperature indicating and recording controllers capable of maintaining a close temperature tolerance up to 1,000° C. The total capacity of the six heating units is 12 tons/hr. of brass when heating up to 750° C. Two sets of heating coils have been supplied by the manufacturer, 7 in. and 8½ in., although to date only the larger size has been used. Within these coils, a maximum billet length of 31½ in. can be accommodated; adjustment is in ½ in. steps, which, of course, must be carried out before production begins. Heater controllers are centralized in a panel immediately behind the operating position, rendering the adjustment of temperature an easy matter.

Power factor correction of the heater installation is provided by six banks of capacitors, each having a total rating of 900 kVAr. Switches are provided within each bank to enable the selection of capacity rating to be in accord with the power input to the billet heating coils.

Power supply for the heating instal-



lation is provided by two transformers, the furnaces being grouped into two banks of three for this purpose. Each transformer is rated at 1,800 kVA, 11 K/3·3 kV, and feeds via temperature controlled contactors.

The equipment is so designed that each furnace is normally maintained in the loaded condition, and any or all may be in operation at any given time. When in use, as soon as the billet reaches the predetermined temperature, indication is given on a control desk sited next to the press control desk. The heater then automatically goes into "stand by", in which the billet is maintained at temperature until selected for extrusion.

At any given time, a glance at the control desk gives the operator a full picture of the heater furnace billet position. When selected for extrusion, the hot billet is ejected from the furnace on to a conveyor belt which delivers it into the feed mechanism of the press proper.

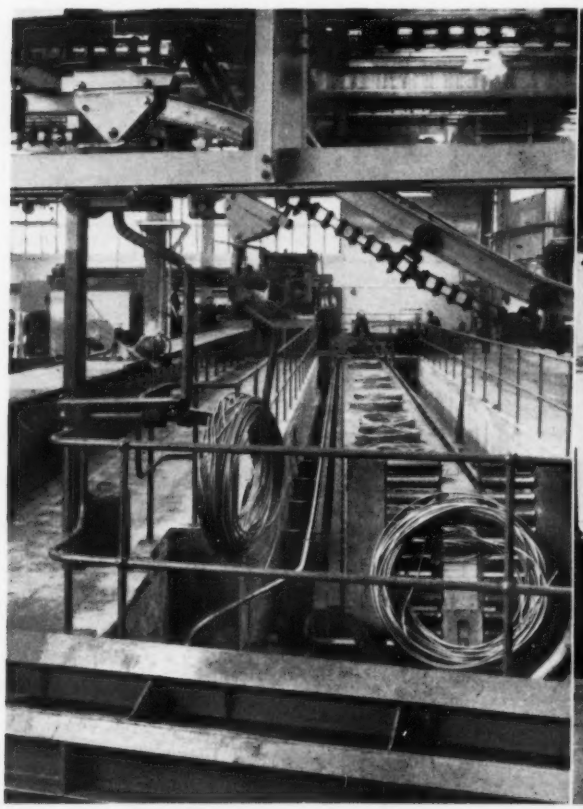
The horizontal extrusion press has a power of 2,500 tons, operating with oil as the pressure medium at a working pressure of 4,500 lb/in^2.

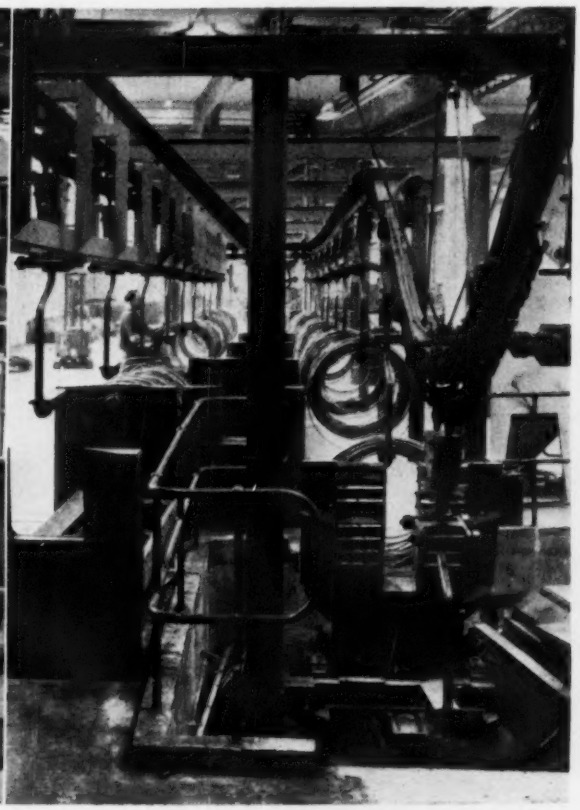
Power is provided by 14 Towler high-speed oil pump units directly connected to three 280 h.p. and one 140 h.p. electric motors, all located in a basement adjacent to the press site (this ensuring the maximum utilization of the upper floor space).

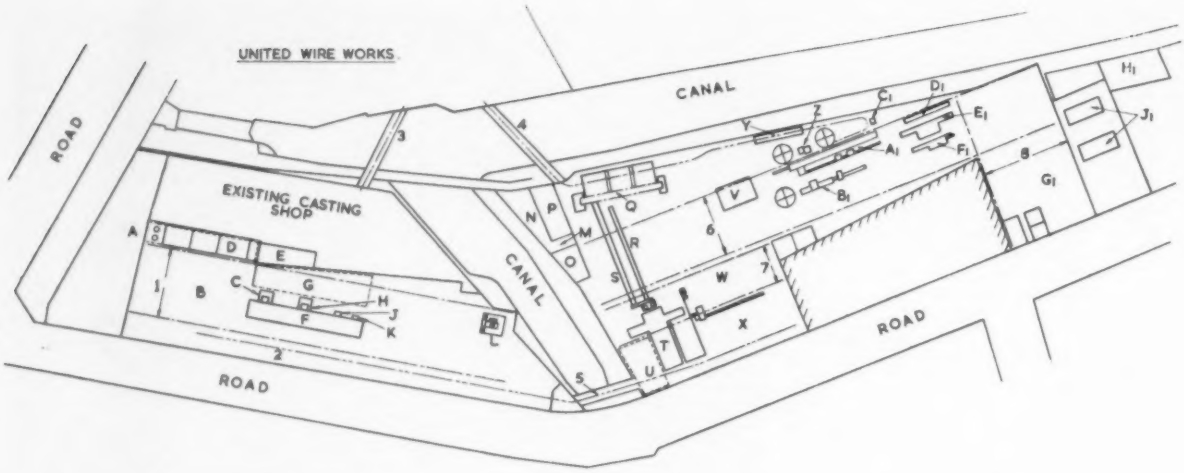
Simultaneous extrusion of two ½ in. coils, each weighing approx. 200 lb. The tube guides which conduct the metal from the die into the centrifugal coilers can be seen in the centre, and on the right is the traverse table which transfers coils to the head of the conveyor line

Below left: Discharge end of the coil conveyor looking towards the press itself. The table in the foreground rotates through 90° to enable the coils to be picked up by hooks suspended from the overhead track

Below right: Overhead track on which coils are cooled and carried from the coil conveyor prior to entry into the rod mill







A—Underground fume extraction plant for new and old casting shops. B—Metal storage area. C—Future 2 ton electric furnace. D—Swarf bunkers. E—Power house. F—Casting pit. G—Electrical equipment for new furnaces (underground). H—2 ton electric furnace. J—1,500 lb. electric furnace. K—Gas-fired priming furnace. L—Continuous casting plant. M—Switch room above transformer rooms and die shop. N—Die shop. O—Compressor room. P—Transformer rooms. Q—Overhead coil handling equipment. R—Run-out table for bars. S—Coil conveyor. T—2,500 ton extrusion press. U—Press pump house (underground). V—Bar pickling tanks. W—Cut billet storage area. X—Cast billet storage area. Y—Coil pickling tanks. Z—Nick and break machine and swaging machine. A1—Hydrobench. B1—No. 1 Schumag. C1—Testing machine. D1—Saw bench. E1—No. 4 reeling machine. F1—No. 3 reeling machine. G1—Despatch warehouse. H1—Engineering stores. J1—Storage racks and stacker crane.

1—56 ft. crane span. 2—No. 1 Telpher runway. 3—Existing Telpher runway. 4—No. 2 Telpher runway. 5—No. 1 Telpher runway. 6—50 ft. crane span. 7—32 ft. crane span. 8—70 ft. crane span.

Diagram showing plan of new extensions at United Non-Ferrous Metals Ltd.

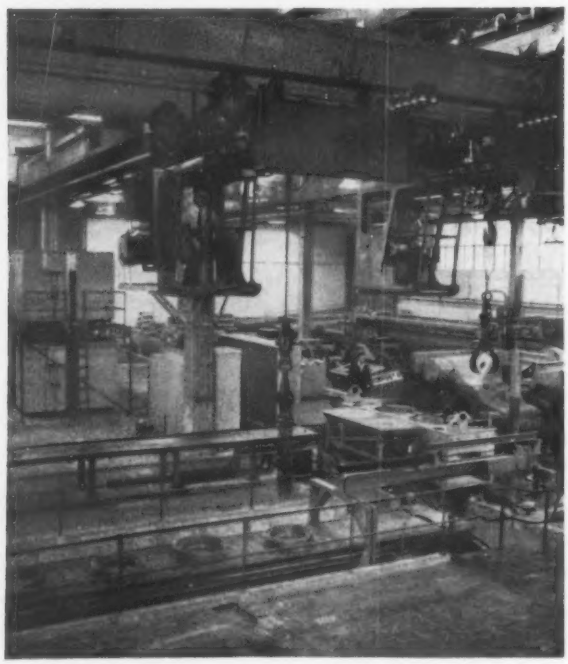
Prominent in the design of this press are the features provided enabling dies to be serviced or changed without breaks in production flow. This is achieved by offsetting one of the main horizontal columns, enabling it to act as a fulcrum, about which rotates a die carrier, in which two die positions and a "sticker tool" position are provided. An induction die heater capable of heating dies (in a matter of 2-3 min.) to a temperature suitable for insertion in the press is sited handy to the "service" position.

For press maintenance, much of which involves the handling of heavy equipment, the two rod mill cranes, each of 5 tons capacity, are able to traverse over the press area on a length of 10 ton track additionally to their normal working span in the rod mill. By combined lifting, loads of up to 10 tons can thus be handled over the press. These cranes, which were built by Acrow and supplied by Demag, are further described in a later section of this article dealing with the rod mill equipment.

Facilities are provided for the production of hollow sections in the form of a mandrel moving device. This has special features for adjustment of the mandrel stroke to enable the mandrel to be arrested relative to the die and permit the production of small bore sections and rods. All the adjustment features are motorized and remotely controlled from the press operator's desk, as, of course, are all the movements of the press.

Two cut-off devices are provided on the press for the separation of the extruded product from the billet discard—the length of which is controlled automatically—at the end of extrusion. For cutting rods and solid section, a hydraulic shear is installed behind the die assembly in the press platen, whilst provision is made for the installation of a pendulum saw to cut between the die face and the container to deal with hollow products.

The extrusion discard, together with the backing disc, the cleaning disc and the extrusion shell, are mechanically expelled into a hydraulic discard separator, the discs after separation being placed in the appropriate chutes and returned for automatic inclusion in subsequent press cycles. Control of all press movements and furnace operation is from strategically placed adjacent control desks, the operating



For heavy maintenance handling over the press area the two 5-ton cranes can traverse on to a 10 ton track in the extrusion shop. Here the two cranes are shown at the latch points where the transfer from one track to the other takes place

position of each providing the best possible view of the mechanisms under control. By selection of the appropriate control system, the operator has the choice of fully automatic operation, a single cycle automatic operation, or hand control of each individual operation—as desired. Extrusion speed control is independent of the type of operation being used and is provided in fourteen fixed steps giving speeds from 0·08-1·12 in/sec. By these means, the greatest possible flexibility of the whole plant is achieved, resulting in high output with close quality control.

Straight extrusion products are received on a flat run-out table, where they are straightened on the table and, after partial cooling, cut to length on a Radiac saw supplied by Geo. H. Alexander and Co.

Coiled rod and strip are fed into two vertical axis coilers of special design with hydraulic variable speed drive. When handling rod, the coilers operate on the centrifugal principle, whilst for strip coiling a special torque limiting device is used which enables pancake coils of controlled tightness to be wound. In both cases, the coiled material is ejected from the coilers by rising bottom plates and pushed on to a transfer table. This then automatically lowers the coils to ground level by travelling down an inclined trackway where they are then transferred to a moving slat conveyor for cooling.

At the end of this conveyor, coils are tipped individually into a chair, which rotates through 90° and at the same time tips the coil into the vertical position. It is then received on the hooks of a special coil handling installation running on an overhead track and which ultimately loads the coils on to the booms of special bogie cars.

From this operation, coil material is then available to feed either the wire mill, to which it is removed by an overhead telpher, or the automatic drawbenches—with which the new rod mill is equipped—by means of fork lift trucks or overhead crane.

Power for all the press shop is supplied from a glass-sided sub-station sited some 30 ft. above ground level, in such a way that switchgear indicating lights are clearly visible from the press control position.

All material from the press is, of course, carefully checked for "extrusion pipe" and other defects before transfer to the other departments.

Reference

[1] Ellwood, Prytherch and Phelps; *J. Inst. Met.*, 1956, **84**, 319.

(To be concluded)

MEN and Metals

Deputy chairman of Consolidated Zinc Corporation Limited, **Mr. A. M. Baer** has been appointed chairman of the company in succession to the late Mr. L. B. Robinson. He has also been appointed chairman of New Broken Hill Consolidated.

Called to the Bar in 1921, the year in which he joined Henry Gardner and Co. Ltd., Mr. Baer became a director of that company in 1927. During the war he was Joint Controller of Non-Ferrous Metals, Ministry of Supply. He joined the Consolidated Zinc Corporation at the beginning of 1950, becoming deputy chairman in 1957. Mr. Baer is also on the board of Broken Hill Secretariat.

Among the many other directorships he has held are those of Metal Market and Exchange Ltd., National Alloys Ltd., Imperial Smelting Corporation, Zinc Corporation Ltd., National Smelting Corporation Ltd., and Yukon Consolidated Gold Corporation Ltd. Mr. Baer was for a time chairman of H. J. Enthoven and Sons Ltd., a post which he resigned in 1960 in order to limit his commitments.

A present member of the British Overseas Mining Association, Mr. Baer has also served on the councils of the Institute of Metals, the British Non-Ferrous Metals Research Association and the Zinc Development Association.

Appointed deputy chairman of Consolidated Zinc Corporation Limited, **Lord Baillieu** is also President of the Dunlop Rubber Co., is deputy chairman, Central Mining and Investment Corporation, and holds directorships in the banking and insurance fields. He was deputy President of the Federation of British Industries in 1944-45 and President for 1945-46-47. He is an honorary member of the Institution of Mining and Metallurgy, the Institute of Metals and the Australasian Institute of Mining and Metallurgy (Inc.).

In succession to **Mr. Harold J. Cotes,** who has retired from the board, **Mr. D. N. Walton** has been appointed chairman of British Glues and Chemicals.

At the annual general meeting of the Scientific Instrument Manufacturers' Association of Great Britain, held in London recently, **Mr. A. W. Jones** was installed as President for the year 1961-62 by **Mr. G. C. Ottway,** the retiring President, who now becomes a Vice-President of the Association. Other honorary officers elected were—**Mr. R. E. Burnett,** Vice-President; **Major Wm. Logan,** hon. secretary, and **Mr. G. S. Sturrock,** hon. treasurer. Newly-elected members of the Council were: **Mr. J. E. C. Bailey,** C.B.E., **Mr. A. G. Peacock, Mr. L. B. Lambert, Mr. J. E. T. Haile, Mr. I. C. M. Worsfold, Mr. H. Wyn Griffith,** and **Mr. A. Richardson.**

The board of Pantak Limited has been strengthened by the appointment of **Mr. H. C. H. Matthews,** B.Sc., A.M.I.E.E., as a technical director.

At the annual general meeting of the Institute of Welding, held recently, **Mr. Harry West,** M.Sc., M.I.Mech.E., M.I.E.E. (managing director of A.E.I. (Manchester) Limited), was installed as President for the 1961-62 year. Two new Vice-Presidents were also appointed: **Mr. C. Humphrey Davy,** M.I.Mech.E. (director of Babcock and Wilcox Limited) and **Mr. L. Redshaw,** M.Eng., M.R.I.N.A. (deputy managing director, Vickers-Armstrongs (Shipbuilders) Limited).

The following have been elected to the Council of the Institute of Welding: **Mr. E. V. Beatson,** B.Sc., M.I.E.E.; **Mr. M. Birkhead,** A.Met., A.I.M.; **Mr. V. W. Clack,** A.M.I.Mech.E.; **Mr. A. Evitts; Mr. S. H. Griffiths,** F.I.M., M.I.S.I.; **Mr. J. Hooper; Mr. J. McLean;** and **Dr. R. Weck,** Ph.D., M.I.C.E., M.I.Mech.E.

It has been announced by Tempered Group Limited that two new appointments have been made to the board of directors of Henry Rossell and Company Limited, one of the companies recently acquired by the group. They are **Mr. John E. Gibb,** until now establishment manager of Tempered Spring Company Limited, another member of the group, and **Mr. Kenneth G. Settle,** A.A.C.C.A., secretary-accountant of Rossells.

Chairman of Monsanto Chemicals, **Sir Miles Thomas** has joined the board of the Dowty Group. He is also chairman of the Development Corporation for Wales, of Forth Chemicals, and a director of several other companies. He resigned, last December, his post as deputy chairman of British Glues and Chemicals. He has also been chairman of B.O.A.C. and has held a number of Government commissions.

New appointments in the Alfred Herbert organization include those of **Mr. B. C. Harrison** as deputy managing director. He became a member of the board in 1947, was appointed as a works director in the same year, and became director of design in 1955. **Mr. A. E. Smith,** who joined the company last April, has been appointed as deputy financial director. **Mr. J. W. Ellson** has resigned from the board.

OUT OF THE MELTING POT

To be Studied PHOTOGRAPHIC methods used for quantitative recording, as for example, in spectrographic analysis, however useful they may be, nevertheless introduce additional sources of error into the evaluation of the results. To such errors must be added a measure of uncertainty in regard to the actual mechanisms involved in situations in which photographic plates are used for recording other than purely optical effects. A situation of this kind is encountered in recent Russian work on atmospheric corrosion rates of pure aluminium and magnesium in relation to the relative humidity, in which work, photographic plates were used to measure the rate of corrosion by the blackening caused by the hydrogen peroxide evolved at the corroding metal surface which was placed in contact with the photographic plates. Both relative and absolute results were obtained, the latter by calibration in which blackening produced by exposure of plates to hydrogen peroxide solutions of different known concentrations was determined. In the corrosion tests, exposure of the plates to the corroding metal surface was preceded by abrasion of the surface in the atmosphere of controlled relative humidity. During the first 15 min., a linear relation was found to exist between the logarithm of amount of hydrogen peroxide formed and the relative humidity (0 to 90 per cent). The appreciable blackening produced in an atmosphere of zero relative humidity remained unexplained. Different parabolic relations were found to hold between the amount of hydrogen peroxide formed and the relative humidity during various stages of corrosion extending over a 6 hr. period at different relative humidities. This interesting work will certainly have to be followed up and extended both in regard to the experimental method and to the results and their explanation.

Anti-Perspirant GENIUS of the type composed of one per cent inspiration and ninety-nine per cent perspiration could hardly be expected to remain popular in these "commercial"-ridden days. No matter that the perspiration was of the metal variety, it clearly had to be banned. The modern answer to this kind of perspiration has apparently been found in the field of electronics. Electronic computers and their ilk have, of course, been with us for some time, but so far have lacked the invaluable "build-up" which can transform a piece of soap into a compulsive social necessity. Electronics are all very well, but intellectronics are so much better, especially when presented with the usual promise of success and achievement. In this case: "machines will free humans for creative work. In partnership, the machine will do the routine repetitive work. Thus the human brain, its million-times more brilliant team-mate, will be free for creative work". The tricks of the trade are all there. There is the flatter—"brilliant team-mate". There is the promise—"creative work". And there also is another example of rushing into something which, although it can be made to work, is as yet not fully understood, something that is still developing into nobody knows what and, above all, something the consequences of which, apart from the "promises", have hardly been considered, let alone thought out. There, also, is another example of progress to be achieved by splitting up a situation and a process—the functioning human mind—into their components, regardless of whether they were ever meant to be split up or not, or whether they will ever be the same afterwards. In this connection, the fact that otherwise intellectronics would hardly be required to free humans for creative work, is, of course, irrelevant. A genius doing creative work and for the rest exerting himself no more than is necessary to start his intellectronic team-mate is undoubtedly a delightful vision, but equally undoubtedly, it will not be what a creative genius used to be. His achievements, too, will be different.

"With It" LIKE all perfectionists and visionaries, those working towards perfect information retrieval systems must have their moments of despair. There they are, elaborating the perfect analytical systems that will be capable of going into reverse on demand and synthesizing a complete story from selected constituents, thereby preventing the wasted toil of rediscovering these constituents and re-telling the story by dint of laboratory efforts. There, before their very eyes, numbers of potential beneficiaries of their labours are forever rushing off to duplicate, triplicate and multiplicate research with apparently hardly a thought being given to its cost, prospects or, indeed, necessity. The fact that this happens at the dictates of the *dernier cri* in pure research and a desire to keep up with the scientific Jones's, is likely to add to the despair of the, paradoxically, more logical perfectionists and visionaries. One current despair of this kind is fast developing in the field of research on the effects of high pressures and temperatures. Research in this field had been going on steadily for many years. Basic data had been accumulating and, together with an element of insight, foresight or luck, had led up to the synthesis of diamonds. Nothing succeeds like success, at least in setting a fashion. As in the rag trade, the successful original creations have now been followed by off-the-peg "barogenic machines" (=presses) at prices from 4,500 dollars to 125,000 dollars each, depending on working pressures and temperatures. The most powerful produce pressures of 1·5 million lb/in^2 with sample temperatures over 5,000°F. The interest being shown is such that, in America, one manufacturer alone has sold 34 barogenic machines in the last 18 months. Ultra-high pressure projects are being taken up in Government, university and industrial laboratories. Experimenting by industry is reported to be strongest in the fields of electronics, chemicals, metals, ceramics, atomics, and missiles and aircraft. In fact, it looks as if anything that can be squeezed and heated is already being squeezed and heated.

Skimmer

Galvanized Strip Production

The recent trend towards unitized body construction for American motor cars has been accompanied by a demand for materials with improved corrosion resistance, and large tonnages of zinc-coated steels, the preferred materials, are now being used. A report giving an account of current practice in the U.S.A. has been issued by the Zinc Development Association. We publish here that part of it which describes some of the specialized techniques used in the production of the special grades of hot dip galvanized strip.

DEPENDING on the forming requirements of galvanized strip for use in the automobile industry, the type of basis steel used would vary. Rimmed, balanced, and fully killed steels have been used, and even in the case of the annealing-in-line (Sendzimir type) process some pre-annealed material was used as the feed material where necessary to produce grades suitable for very severe forming.

The extra deep drawing qualities, which were supplied on demand, were always aluminium-killed steels (to minimize ageing effects), which were subsequently temper rolled between ¼ and 1 per cent to avoid stretcher strain markings.

Bath Analysis and Control

The type of zinc used for strip galvanizing varies from plant to plant. In some cases, the metal is almost entirely pre-alloyed (0·3-0·33 per cent aluminium) although small regular additions of a master alloy, usually containing 10 per cent aluminium, are necessary. In other cases, virgin zinc was employed, and additions of a zinc 10 per cent aluminium master alloy made to the bath.

The normal bath compositions aimed at are 0·15 to 0·25 per cent aluminium, but the aluminium content is usually adjusted with reference to the type and gauge of strip being processed. Thus, baths with higher aluminium contents (up to 0·5 per cent) must be used for heavily worked steel and for heavy gauges (because of the lower line speed and, hence, increased immersion time) and for aluminium killed steels. The lead content varies from about 0·2 to 0·35 per cent, and the only other deliberate addition to the strip galvanizing bath is antimony (found in one case only).

For bath control, regular determinations of the aluminium content of the bath were made, but in the case of the Cook-Norteman type line, the standard practice was to analyse the coating for iron. For normal rimming steels (where a bath composition of 0·2 per cent aluminium was aimed at and maintained) the coating analysed about 0·14 to 0·17 per cent aluminium.

Since the level of the nip in the rolls (and hence in the bath itself) is also important in the control of coating thickness, automatic devices were used in some cases to indicate the required additions (of both the slab and master alloy) with respect to the gauge of steel being processed and the desired coating weight.

Control of Coating Thickness

For the standard coatings which are produced, some use is being made of electronic scanning (Beta ray) gauges and these are at present in operation on four or five galvanizing lines. (The cost of these units was estimated to be about £20,000.)

Apart from the thickness control, by gauging and by control of the bath composition and level, increasing attention is also being paid to roll design and roll conditioning techniques which have an obvious effect on uniformity of coating thickness. Rolls with spiral and concentric grooves are used, with perhaps slight preference being shown for the latter. Groove dressing operations are largely a matter of routine, but the use of spiral grooves permits automatic groove dressing by a travelling scraper. Although this technique has been considered by several plants, there was no evidence of it being in operation. For the rolls themselves, some firms preferred to use high purity iron (or dead mild steel), whereas others claimed advantages for heat-treated carbon steels (up to about 0·25 per cent carbon), which were claimed to provide a more uniform surface condition. Some thought was being given to the use of rolls with protective coatings, particularly chromium plated rolls.

The normal limits for variation in coating thickness were stated to be ±10 per cent from edge to edge, and ±20 per cent from back to front. In order to prevent edge build-up, the use of air blasts was being considered in some cases.

Two techniques had been used for the production of differentially coated steels carrying about 0·15 oz/ft^2 on one side and 0·5 oz/ft^2 on the reverse side. The more common technique was to use a case-hardened steel blade (⅛ in. radius) followed by an asbestos pressure pad on the "wiped" side. The alternative technique was to use as one of the exit pair of rolls, a smooth roll whose axis was above that of a standard grooved roll.

For the production of galvanized strip coated on one side only, various types of masking compounds had been used.

Neither sodium silicate (the more widely used compound) nor sodium aluminate was completely effective in preventing wetting of the "uncoated surface", and this surface usually required a subsequent scratch brushing treatment to remove local zinc. The net result was to produce a roughened surface, unacceptable for the skin panels of the cars for which it was intended. Greater success was claimed for a water-soluble borate masking compound, but there was no evidence that material produced using this technique had been supplied to the automobile industry. At the present time, only a very limited amount of differentially coated material, and no one side coated hot dip galvanized strip, is being used.

Work is in progress on the development of superior masking compounds.

Finishing Treatments

To produce the matte "minimized spangle-satin finish" material required by some sections of the industry, steam jet cooling of the surface of the hot dip galvanized sheet, as it emerged from the galvanizing pot, was the general practice. In one case, however, a dilute copper sulphate solution spray replaced the steam jet cooling.

The position of the steam pipe was adjustable for different gauges and different line speeds, and in the simplest arrangement the adjustment consisted

simply of hooks positioned at 6 in. intervals on vertical support columns on either side of the moving strip. The horizontal jet spacing varied usually from ¾ in. to 1½ in. The position of the jet pipe varied between about 5 ft. to 15 ft. from the surface of the bath. In one case, provision was made for movement of the jet pipe in the horizontal plane over a range of ¾ in. to 6 in., but in most cases it appeared that the jet/strip distance was about 1 in. to 2 in. Jets were usually inclined upwards at an angle of 45° to 60°, and it was claimed that poor results had been obtained when slots had been used.

It was general practice to have a long extension to the steam pipe on the exit side in order to maintain a reasonably uniform pressure in all the jets. Both saturated and dry steam were used, users of each claiming superiority over the other. A further refinement of the surface was obtained by passing the cool strip through grit blasted rolls (usually 80 to 90 grit), a reduction of between ¼ and 1 per cent being given to the strip. In addition to the refinement of the surface this treatment was also intended to eliminate the fluting tendency.

All hot galvanized strip supplied to the motor industry was subsequently oiled. Strip supplied to other industries was, however, invariably given a chromate finish either in sodium dichromate/sulphuric acid solutions, straight chromic acid solutions, or in chromate solutions which produced deposits rather than conversion type coatings. These methods of finishing strip were all in use.

Cobalt

COMPREHENSIVE TEXT COVERS HISTORY, PROCESSING AND PROPERTIES

FROM antiquity to the present day cobalt has been known and used, and its history is admirably dealt with in a monograph prepared by the Battelle Memorial Institute of Columbus, for the Centre d'Information du Cobalt. It deals not only with the history, but with the occurrence of cobalt in nature, mining and extraction by smelting, hydrometallurgy and electrowinning processes.

As far back as 2250 B.C., in Persia, cobalt was being used for colouring glass, and a necklace has been discovered containing a number of blue glass beads coloured with cobalt. Cobalt-coloured glass was common in 1480 B.C. The term "Kobelt" was used by Agricola to designate a substance found in silver mines of the Erzgebirge region, Saxony, which injured miners' hands and feet when working in damp conditions and also affected their eyes and lungs: the term was related to a mischievous spirit or gnomes which lived in the mines.

From the sixteenth century until the end of the nineteenth century, the world's production of cobalt came from Sweden, Saxony and Hungary. Cobalt compounds are used in enamels, paints and varnishes. They are also used as catalysts for synthesized methane and liquid hydrocarbons. They are also used to treat certain deficiency diseases in sheep; traces of cobalt are essential in human nutrition, and it is an important element in vitamin B_{12}.

Development

Cobalt-chromium alloys—Stellites—have replaced platinum to some extent in dental metals; cobalt-chromium-tungsten alloys are used for high speed cutting tools and for hardfacing wear-resisting alloys. Cobalt is also used for the manufacture of magnets, high temperature alloys and additions of cobalt are added to tungsten carbide for sintering powdered compacts to produce hard metal tools.

In 1937, cobalt isotopes Co^{55}, Co^{56}, Co^{58} and Co^{60} were discovered and produced artificially. Since 1948, radioactive Co^{60}, produced by irradiating metallic cobalt in an atomic pile, has found numerous uses as an emitter of gamma rays used in radiography, radiation therapy for cancer treatment and control devices. Today, cobalt of 99·99 per cent purity can be produced. In 1956, the world's production of cobalt reached 12,700 tons per year.

Mining and Extraction

The world's largest cobalt producer is The Union Minière du Haut-Katanga, in the Belgian Congo. Most of the cobalt comes from two mines, the Musonoi and Kamoto open pits, which are located near Kolwezi, 205 miles north-west of Elizabethville, capital of the Katanga Province.

These mines are highly mechanized. They have electric shovels (of 4 to 6½ yd^3 capacity), load trains of 6 to 8 dump-cars hauled by electric locomotives, the ore being mined in strata of 33 ft. high. 3,200,000 tons of ore were taken from the Musonoi mine and 2,500,000 tons from the Kamoto mine during 1957. Other mines are worked in Northern Rhodesia, Morocco, Uganda, U.S.A., Canada, Cuba and U.S.S.R.

The ores found near Kolwezi are complex copper and cobalt; thus a great deal of work had been carried out to develop efficient methods to concentrate their tenor-values. The ores are divided into several classes, which are treated separately at the Kolwezi concentrator: copper oxide ore containing minor amounts of cobalt; copper-cobalt oxide ore, containing approximately equal values of the two metal constituents; mixed ore, containing both cobalt and copper oxides and cobalt and copper sulphides.

Highly satisfactory concentration methods for the copper oxide ore have been developed. This ore contains 5-6 per cent copper and 0·2 per cent cobalt; it is floated with hydrolyzed palm oil. Sodium carbonate and sodium silicate are used as conditioning agents. The concentrate assays 26-27 per cent copper and about 1·0 per cent cobalt. The recovery of copper is about 84 per cent.

Copper-cobalt oxide ores are similarly treated—a dose of 5-7 per cent of tall oil is added to the palm oil to increase the frothing power of the mixture. The cobalt recovery is about 70 per cent and copper about 82 per cent. The concentrates are sintered and treated by electric reduction smelting.

Mixed ores go through the following processes: grinding to 200 mesh; flotation of the chalcocite with xanthates and frothing agents; flotation of the malachite by superficial sulphidization by means of an alkaline sulphydrate and collection with xanthate; regrinding and refloating of the middlings.

Close control over the frothing characteristics is imperative and this is carried out by the addition of starvation quantities of an emulsion composed of gas oil and palm oil. The sulphide concentrate is treated in a fluo-solid sulphate roasting furnace before leaching for hydrometallurgical processing.

The actual solids content of the solution fed into the electrolytic tank room is from 0·10-0·15 gm/L. Because the current efficiency in the electrowinning process is reduced by the presence of iron in the solution, the ferrous sulphate content is maintained just at the level required for the dissolution of cobalt. The excess iron is removed by bringing the *p*H of part of the solution to between 2·0 and 2·5 through the addition of copper hydrates, a product available from the cobalt plant. Cobalt is not deposited with the copper; thus, the solution becomes gradually enriched in cobalt. The solution also contains some nickel, zinc, manganese and magnesia.

Electrolytic deposition of cobalt is only possible in a neutral solution. Consumption of energy during elec-

trolysis amounts to 6·5 kW/hr. per kilogram of cobalt at a current density of 500 amp/m² (47 amp/ft²). The per cent composition of the cobalt cathodes obtained is: cobalt 93, nickel 0·27, iron 0·06, copper 0·02, manganese 0·2, zinc 2·0, sulphur 0·2 approximately.

The cobalt cathodes are refined in an electric arc furnace. Desulphurization is ensured by a high lime reducing slag after the manganese has been oxidized; the zinc is, to a large extent, volatilized at the beginning of the melt and is completely eliminated by poling. The molten cobalt is granulated in water.

Properties

There are 13 known isotopes of cobalt. Their mass numbers range from 54 to 64; isotope Co^{59} is stable. Cobalt has two allotropic modifications: a close-packed hexagonal form (epsilon) stable at temperatures below 417°C., and a face centred cubic form (alpha), stable at higher temperatures up to the melting point of 1,495°C. Transformation from epsilon to alpha is sluggish, due to the low free energy change associated with the f.c.c. to h.c.p. transformation of cobalt. This may be related to the binding energy, being associated with the directional (homopolar) interaction of (d) electrons, which implies that the stacking-fault energy is small. Grain size has considerable influence on the transformations. Transformation in cobalt appears to be one of the simple diffusionless transformations, which involve only a single shear process. Since the stacking-fault energy is extremely small in the temperature range given, a method based on grain boundary measurements appears to be the most promising study leading to information on the irreversibility of the transformation, in spite of the fact that considerable work has been carried out by dilatometric investigations.

The cobalt alloy systems are numerous. The solubility of aluminium in cobalt is 15·5 at. per cent at 1,400°C., decreasing with falling temperature to 2 at. per cent at 300°C. The solubility of boron is even much more restricted than that of aluminium, and reaches a maximum of 5 at. per cent boron. Both the magnetic and allotropic transformations are depressed by boron. Cobalt and carbon form a eutectic with 3 per cent (4·5 at. per cent) carbon, the solubility decreasing with falling temperature to about 1·7 at. per cent. Carburization of cobalt powder at 220°C. is almost nil. The existence of Co_2C has been established: it has an orthorhombic structure similar to that of Fe_2N. Cobalt carbide decomposes eutectoidally at 685°C.

The cobalt-chromium alloys are well established. They have wide solid solutions and the presence of an intermediate phase CoCr. The solid solubility of chromium in cobalt extends to 41 at. per cent chromium at 1,310°C. decreasing with falling temperature to 38 at. per cent chromium at 960°C., the solubility decreasing markedly as the temperature falls. The solubility of cobalt in chromium is also extensive. An interesting technological factor is the formation of the sigma phase, which is formed peritectically from the liquid and the chromium-rich solid solution at 1470°C. and undergoes a transformation at temperatures between 1,310°C. and 1,260°C. (according to composition). A limiting degree of ordering of the cobalt and chromium atoms appears to exist.

With the cobalt-copper alloys, solid solutions are comparatively restricted and do not exceed 12 at. per cent copper in cobalt. Both the magnetic and allotropic transformations in cobalt are lowered by copper. Cobalt is precipitated from supersaturated solid solutions in copper, which is of interest in connection with the theory of magnetic alloys.

The cobalt iron system has been extensively studied. There is an indication of the equiatomic alloy ordering at 730°C. and increasing more sharply at 550°C. This is of some technological importance as it may account for the embrittling factor of alloys containing 35-68 at. per cent of cobalt, which is due to the hardening brought about by both the short and long range order.

Many other binary alloy systems are given in this monograph, and some references are given regarding the atomic size factor influences on such alloys. A number of ternary systems are also discussed and these are of particular interest to the physical metallurgist.

Cobalt in high temperature alloys and the metallurgical development of superalloys and other creep-resisting alloys are discussed at great length, as is the effect of cobalt in magnetic materials.

The latter part of the monograph is taken up with the influence of cobalt compounds in glass and ceramics, catalysts, driers, pigments, radioactive cobalt and its industrial applications, cobalt in agriculture, animal nutrition, and medical aspects of cobalt.

In its 515 pages, this book contains a great amount of up-to-date information on cobalt. It is priced at 750 Belgian francs and is obtainable from Centre d'Information du Cobalt 35, rue des Colonies, Brussels 1.

Tube Straightening

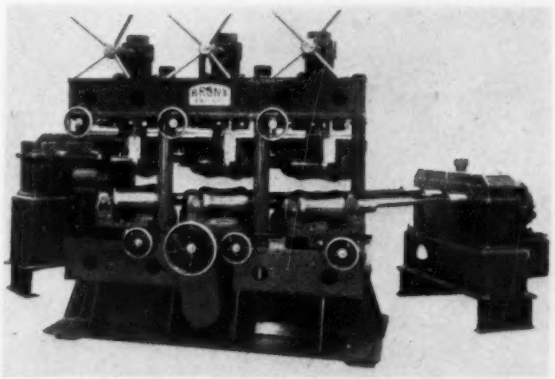
SUITABLE for straightening ferrous and non-ferrous tubes from $\frac{3}{8}$ in. up to $3\frac{1}{2}$ in. diameter, the Bronx multi-cross roll tube straightening machine, series 6.CR.7, includes the following features: all rolls are driven; no guide bars are required between the rolls, therefore there is no marking of the material; the tube is held between three pairs of line contact rolls; the rolls can be easily adjusted so that the tube is perfectly supported.

The drive to the rolls is taken from two totally enclosed gearboxes with vee belt drive from two motors and to permit full adjustment of the rolls, universal couplings and spindles are fitted between the rolls and the gear drives.

All three upper rolls are adjustable vertically to suit tube dimensions. In the case of the centre rolls, both bottom and top rolls are adjustable vertically to enable the necessary deflection to be applied to the tube. All rolls have angular adjustment for line contact setting.

This machine can be provided with single speed motors to give a fixed straightening speed of 250 ft/min. or with two- or three-speed motors to give a straightening speed up to 400 ft/min.

Tube straightening machines of this type are now manufactured by Bronx Engineering Co. Ltd., Lye, Stourbridge, to cover a complete range of tubes from 0·020 in. up to 12 in. diameter.



Bronx multi-cross roll tube straightening machine series 6.CR.7 for tubes from $\frac{3}{8}$ in. to $3\frac{1}{2}$ in. in diameter

Standard Specifications

SMOKE EMISSION — DOMESTIC BOILERS — DENTAL ALLOYS — SCREW THREADS

Measurement of Smoke Emission from Industrial Boilers. Part 2 (*B.S.*2978). *Price 7s. 6d.*

THE report of the Committee on control of industrial smoke, covering coal-fired shell boilers with various types of mechanical stokers, has now been published as Part Two of the British Standard on "Measurement of Smoke Emission" (B.S.2978). It is unlikely that further reports, other than addenda to those already published, will be issued as the majority of other plant in general use comes under the supervision of Government inspectors.

This report will be of value, as was the earlier document, to factory management and to local authorities in helping them to achieve a good standard of smoke control and compliance with the law under the terms of the Clean Air Act.

To obtain the material on which this report is based, the B.S.I. Committee carried out tests on eight shell boilers of modern design, known to be well-operated, in various industrial establishments. Detailed records were kept of smoke emission from each of these plants over periods of from three to eight weeks.

A résumé of results for each of the boilers is given in the form of a table, with notes on the frequency with which various associated operations were performed and the level of smoke emission during such operations.

The final conclusion is that "dark smoke from well-designed and correctly operated shell type boilers with mechanical firing equipment of the types tested should not exceed 8 min. in any period of 8 hr".

A section at the end of the report lists factors influencing smokeless combustion in shell type boilers with mechanical stokers.

Back Boilers for use with Domestic Solid Fuel Appliances (*B.S.*3377: 1961). *Price 3s.*

MATERIALS and constructional requirements for back boilers for use with domestic solid fuel appliances are laid down in this new British Standard. Boilers for independent domestic hot water supply or central heating are not dealt with, as they are already covered by other British Standards.

Dental Gold Solders (*B.S.*3384: 1961). *Price 3s.*

REQUIREMENTS for two types of dental gold solders are laid down in this new British Standard: those intended for general purpose use (type A) and those of lower gold content, not generally recommended for fixed restorations (type B). Composition, shape and size, workmanship, melting range and quality of union are dealt with. Appropriate tests are laid down.

When a solder is claimed to comply with the requirements of this standard, packages must be marked with the name or trade mark of the supplier, the type of solder (type A or type B), the solidus and liquidus temperatures, the weight and the number of the standard.

Dental Cobalt Chromium Casting Alloy (*B.S.*3366: 1961). *Price 3s.*

SPECIFYING basic requirements for cobalt chromium casting alloy used for dentistry, this standard lays down composition and mechanical properties. It does not relate to surgical implants.

A package of ingots claimed to comply with this standard must be marked with the name or trade mark of the supplier, the weight of the contents of the package, the batch number and the number of the standard.

Unified Miniature Screw Threads (*B.S.*3369: 1961). *Price 5s.*

UNIFIED miniature parallel screw threads from 1·40 mm. down to 0·30 mm. diameter (0·0551 in. to 0·0118 in.) having the 60° ISO/Unified basic form of thread, are covered by this standard. It has been prepared as a result of discussions by the International Organization for Standardization (ISO) and discussions between the ABC countries (the United Kingdom, Canada and the United States).

In the manufacture of clocks, watches and certain instruments, the peculiar problems involved in miniature work have long been appreciated but these are comparatively new in other directions, such as telecommunications, where miniaturization is now widely used.

The standard deals with thread form, diameter-pitch combinations and design sizes, limits, tolerances and inspection and plated threads. It also deals with designation, and recommends that Unified miniature screw threads should be referred to on drawings and related documents by their basic major diameter in millimetres followed by the abbreviation UNM (for example, 0·80 UNM). Canada, the U.S.A. and the U.K. have agreed on this designation, which may be taken as signifying universally interchangeable within the world-wide scope of ISO, as well as Unified, Metric and Miniature.

The tabulated maximum material sizes given in B.S.3369 agree with the ISO formulae. Although this means they deviate from the American minor diameters, screw threads made to B.S.3369 should in practice assemble with American products and can, for this reason, be regarded as "Unified" in compliance with the Declaration of Accord of 1948 between Canada, the U.S.A. and the U.K.

There is as yet no international agreement on miniature screw thread tolerances, but some notes have been provided in this standard on inspection practice, and tentative American tolerances are given in an appendix.

Copies of the above-mentioned standards may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Aluminium For Architects

IN conjunction with the new Building Service inaugurated by the British Aluminium Company Limited, a manual, "Aluminium for Architects", has been compiled in such a way as to facilitate ready and rapid reference. It is divided into five sections as follows:

The first section includes information about, and instructions for using, the manual, details of the head office, and regional and district offices of the British Aluminium Company, and cards for requesting information.

The second section contains all brochures issued by the company in connection with the building industry. The third section gives the names, addresses and telephone numbers of some 350 manufacturers of aluminium building products (not confined solely to users of the company's metal).

In the fourth section are data sheets both for B.A. products and for those of many of the company's customers and potential customers. At the time of printing these sheets are 80 in number, and at least 70 more are in course of preparation.

In the fifth section is given any information not falling readily into any of the previous headings, but of value to the architect, and possibly thought-provoking.

Parallel with this aspect of the Building Service, is an organization designed to maintain the manuals up to date and to cater for enquiries from architects and aluminium users in the building industry.

Industrial News *Home and Overseas*

A Reminder

Members of the **Institute of Metals** are reminded that a conference on the metallurgy of beryllium is to take place at the Royal Commonwealth Society, Craven Street, London, on October 16-18 this year. A full programme and registration form will be circulated to members shortly. The conference, which is international, has been arranged in order to discuss a great mass of hitherto unpublished work on beryllium, and Papers have been received from authors from all parts of the world. The first day and a half of the conference will be devoted to discussion of the mechanical and physical properties of beryllium, with particular reference to deformation and fracture study, elevated temperature ductility and the ductile/brittle transition. Twenty-six Papers are expected in this section.

On the afternoon of the second day the discussion will be concerned with (a) the use of beryllium in reactors, where the emphasis will be on fabrication routes and testing, corrosion and compatibility and irradiation properties (17 Papers) and (b) the use of beryllium in aircraft and missiles (three Papers).

The third day will be devoted to discussion on metal preparation and fabrication, including sections on pure metal preparation and fabrication, the use of beryllium-based alloys, and the application of specific fabrication techniques such as casting, powder metallurgy, rolling, extrusion, forging and joining of beryllium. Thirty-one Papers on these topics are expected.

A New Development

A new range of square ended air cylinders of tie-bar construction has recently been introduced by **Air Automation**. The first sizes to be available are those of $\frac{3}{4}$ in. and 1 in. bore in single-acting, double-acting, and single-acting spring return patterns. These cylinders occupy an absolute minimum of space, yet are stated to have all the features of high quality construction, such as stainless steel rods, brass bodies, and neoprene distributor type "U" seals for both rod and piston.

All cylinders are provided with screwed nose, front face mounting, and rear trunnion mounting, as well as screwed base mounting, and additional front flange mounting plates or foot mounting plates can also be supplied if required.

An Aluminium Bridge Deck

A new Scherzer-rolling-lift bridge in Kingston - upon - Hull is probably the largest road bridge of its type yet built, and it is also noteworthy for the aluminium deck with which it is fitted. The Drypool bridge, as it is known, was designed in the City Engineers' Department and was fabricated by Samuel Bulter Limited. It replaces a "bob-tail" swing span which served at this crossing from 1888 until work started on the new bridge in July 1959.

The new bridge has a span of 105 ft. and an overall width of 70 ft. A road width of 45 ft., compared with the 15 ft. 9 in. on the previous bridge, will do much to improve the flow of traffic through the city. The bridge has also been designed with fast operating speeds to minimize the delay when it is lifted. The 1,400-ton structure can be raised or lowered in either $1\frac{1}{4}$ min. or $2\frac{1}{2}$ min.: the slower speed being used when there is a high wind.

The choice of aluminium for the bridge decking was dictated both by the obvious need to keep the weight of the bridge as low as possible and by the metal's durability. The 40 tons of aluminium plate and section were all supplied by **Alcan Industries Limited.**

The decking is arranged in eight transverse bays between steel cross-girders. Each bay is made up of five prefabricated panels measuring 9 ft. by 11 ft. 6 in. The weight of each panel is only about 2,000 lb. and in consequence they presented few handling problems during erection. The panels are made up as follows: a series of trough sections in Noral alloy B51SWP (B.S.S.1476 HE30WP) are first riveted together to form a corrugated profile $7\frac{1}{2}$ in. deep with a pitch of 9 in. Next, I-beam stiffeners, also in Noral alloy B51SWP, are fastened longitudinally in each trough on the upper side. Fastening cleats for this member are cut from a special extrusion and are riveted to the web of the beam and to the trough section. The prefabricated panel is completed with three $\frac{7}{16}$ in. plates (Noral alloy B51S: B.S.S.1477 HP30) which are bolted and riveted in position on the upper surface. They do not cover the whole panel, in order to allow access for the final assembly.

After the panels have been bolted into position, the deck is completed by fixing the remainder of the plates. To make the most of aluminium's durability, additional protection has been provided by painting all the aluminium components with a bituminous paint. Strict attention has also been given to preventing bi-metallic corrosion where steel and aluminium are in contact.

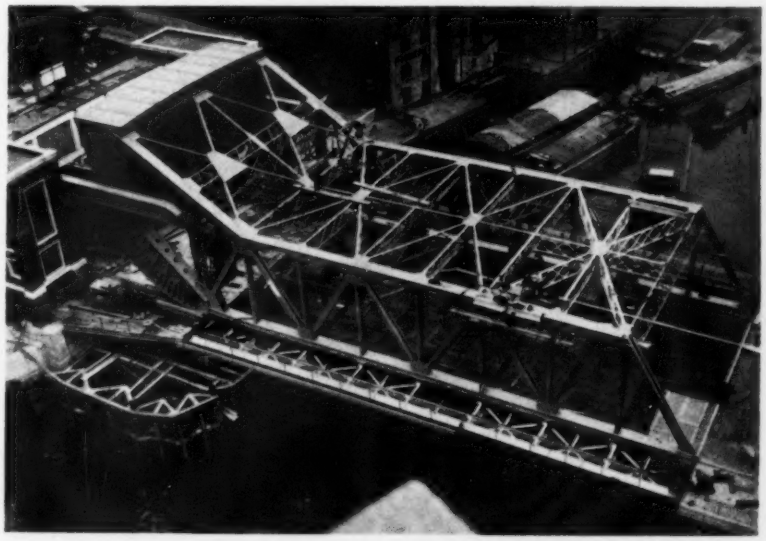
A 1 in. deep aluminium hexagonal mesh is laid on the deck as a key for the road surface. This surface is a hard laid mastic asphalt in two layers: the first, of pure asphalt, fills the mesh, while the second layer, which has precoated chippings rolled in, brings the overall surface depth to $2\frac{5}{16}$ in. A further use of aluminium to be found on the moving portion of the bridge is for aluminium handrailings, which have been made from extruded rectangular bars (Noral alloy B51S) welded together.

Copper Roofing at Research Laboratory

Ruberoid copper roofing, manufactured by **The Ruberoid Co. Ltd.**, has been used to screen from electrical interference one of the new pharmacological and biochemical laboratories at the Beecham Research Laboratories at Betchworth. The laboratory is being used for electrophysiological experiments — such as measuring the potential in nerve fibres— which would be vitiated by outside interference.

For this purpose it was necessary to sheath all the internal surfaces, ceiling, walls and floor, with a good conductor in continuous electrical contact at earth potential, and to ensure that the multiple service pipes or conduit were isolated from outside interference. Fixed by the normal adhesive method, the material was then anchored with nails to the timber battens set into the walls and ceiling. Copper strips were soldered after fixing

A general view of the new Drypool bridge at Kingston-upon-Hull shortly before its completion. This Scherzer rolling-lift bridge has an aluminium deck for which Alcan Industries Limited supplied the 40 tons of Noral extrusions and plate



over all the joints to achieve electrical continuity.

Copper-faced internal shutters screen the window and door openings under actual test conditions. A plenum air conditioning system supplies and extracts fresh air through ceiling vents, which are screened with fine copper gauze. The architect, F. Senior, A.R.I.B.A., Dip.Arch., and the scientists concerned, have expressed their complete satisfaction with the results. The main contractors were Percy Bilton Ltd.; sub-contractors for the taping and earthing required to complete the installation were Buchanan and Curwen Ltd., who also developed the method used for rapid soldering of the copper strips.

This unusual application of Ruberoid copper roofing was carried out by the contract division of the Ruberoid Co., in close collaboration with the main contractors.

New Works and Offices

Designed specially to suit their requirements as manufacturers of magnetic separating and handling equipment, the new works and offices of **Electromagnets Limited** in Birmingham were officially opened this month. The new buildings give greatly improved conditions and facilities for the development and production of their equipment.

The new buildings provide a large machine shop, despatch area, administrative offices, and an attractive and spacious showroom.

Sales Changes

Due to continuing expansion of business in the Midlands area, and also the retirement, after 23 years, of one of the **Desoutter** technical sales engineers, some re-organization of sales territories has been necessary. Mr. K. F. Tunnicliff has joined the Midlands staff, in addition to Mr. M. Giles, Mr. H. Jones and Mr. D. W. G. Smallwood, operating from the Birmingham office.

In the North-East of England, Mr. E. Machan has replaced Mr. J. Fox, who has transferred to North-East London to take over from Mr. C. L. Startup, who has retired. A further new appointment is Mr. P. C. Botting, who will be responsible for the Central London area.

Cables at London Airport

The new engineering and maintenance base which has recently been completed for British European Airways at London Airport at a cost of £6,000,000 is stated to be one of the most highly-mechanized and precisely engineered operations in the history of British building. **British Insulated Callender's Cables Limited** have supplied about 250 miles of various types of cables for the electrical services which alone have cost £800,000. The cables include: PVC (polyvinyl chloride) insulated; PVC wire armoured and PVC sheathed; paper insulated lead covered and PILC with wire armouring; mineral insulated copper sheathed.

Magnetic Separators

Four types of magnetic separators are described in the recently revised Technical Description No. 315, now available from **The General Electric Co. Ltd.**, at Witton, Birmingham, 6. These are: pulley or drum type; suspension type; chute type; and stand-type swarf separators. Information contained in the previous publication has been brought up to date and particulars of a new range of magnetic separator pulleys have been included.

Farnborough Exhibition

At the forthcoming static exhibition, S.B.A.C. Display, to be held as usual at Farnborough, **Reynolds Tube Company Limited** will be exhibiting many of their specialized products, such as flash-welded rings and precision hollow extrusions for the aircraft industry.

Flash-welded rings in heat-resisting metals such as "Nimonic" alloys, titanium alloys, etc., include rectangular dished rings, as well as the more usual circular ones, and rings designed for machining two jet-pipe flanges from one flash-welded ring.

Included among the precision hollow extrusions are air starter cartridge cases, "bodies" for steel pressure vessels, hydraulic cylinders, etc., and exhibits illustrating the wide potential for internal and external integral end forms, and demonstrating the close tolerances achieved. Other exhibits will be indicative of the company's skill in tubular manipulation and assembly.

Two-Day Conference

An announcement from the Institute of Physics and The Physical Society and the British Radio Spectroscopy Group announce that they are jointly holding a two-day conference on "Radiospectroscopy of Solids" in the Department of Physics of the University College of North Wales, Bangor, on September 21-22, 1961.

The Institute and Society's Guthrie lecture will be presented during the conference by Dr. D. Shoenberg, F.R.S., who will speak on: "The de Haas-van Alphen Effect and the Electronic Structure of Metals".

Residential accommodation will be available. Registration is necessary and the closing date for applications is September 1, 1961. Programmes and application forms are available from the Administration Assistant, The Institute of Physics and The Physical Society, 47 Belgrave Square, London, S.W.1.

News from Birmingham

The annual fortnight's holiday starts in the Midland area this week-end. Works are closed except for major repairs which can only be done when wheels are not turning. Business prospects for the autumn are fairly good, but the market will be affected by holidays during the next few weeks. At a recent news conference in Birmingham, Mr. F. J. Errol, Minister of State, Board of Trade, said that car exports promised to improve by the end of this year and show considerable improvement in 1962. He was satisfied that British car firms realized the potentialities of the North American market, and he thought that troubles over after-sales service in the dollar markets had been largely overcome.

Distributors of iron and steel have good stocks of most products and this fact, coupled with greater capacity made possible by expansions at sheet and plate works, has brought considerable speeding up in the matter of delivery over the first half of the year. Future trade is likely to be affected by the austerity measures which the Government are imposing. Meanwhile there is a lull in buying, and output will drop during the holiday season.

A new £100,000 cold rolling mill and welded mesh reinforcement factory has been opened at the Bromford Iron & Steel Co. Ltd., West Bromwich.

Jordan Copper Deposits

It has been reported by the Ministry of Economy, at Amman, that the Jordan Mines Department, in co-operation with German geologists, had discovered copper deposits in Wadi Abu Khsheiba, near Wadi Araba, South Jordan. Ministry sources said the report estimated the deposits at about 22,000,000 tons.

Italian Copper Imports

Statistics issued in Rome show that Italian imports of crude copper during the first four months of 1961 amounted to 7,753·9 metric tons valued at 2,900,927,000 lire, of which 1,176·2 metric tons were temporary imports. The principal suppliers were Rhodesia and Nyasaland with 2,825·8, Union of South Africa 1,629·7 and the United States 2,984·4 metric tons.

Imports of refined copper in slabs, plates, ingots, etc., during the first four months totalled 64,313·8 metric tons valued at 24,054,801,000 lire, of which 6,570·3 metric tons were imported temporarily. The main suppliers during the period were: the U.K. with 4,235·5, Congo Republic 11,291·1, Rhodesia and Nyasaland 9,365·1, the U.S. 24,382·6, Canada 3,003·6, and Chile 4,959·4 metric tons.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 230 tons to 6,255 tons, comprising London 3,156, Liverpool 1,955 and Hull 1,144.

Copper stocks rose 875 tons to 20,852, distributed as follows: London 750, Liverpool 16,077, Birmingham 50, Manchester 3,900, Hull 50, and Glasgow 25.

Lead duty-free stocks fell 14 tons to 9,311 tons, comprising London 8,961, Glasgow 100 and Swansea 250. In-bond stocks fell 75 tons to 3,668 tons (all in London).

Zinc duty-free stocks fell 114 tons to 4,222, comprising London 3,233, Glasgow 106, Manchester 400, Liverpool 483. In-bond stocks fell 10 tons to 2,463 (all in London).

New Colour/Sound Film

From **The International Nickel Company (Mond) Ltd.** comes a new 16 mm. colour/sound film dealing with the refining of precious metals from the Sudbury nickel ores. These ores, mined mainly for their nickel and copper content, contain trace elements of the platinum metals, gold and silver, which are separated from the residues of the nickel and copper refining processes. The film describes the intricate processes employed to refine gold and silver in Canada, and platinum, palladium, rhodium, ruthenium and iridium at the Acton refinery of The International Nickel Company (Mond) Limited, in the United Kingdom.

The film illustrates the chemical processes in detail and many animations are used to assist an understanding of the complex chemical reactions involved. It is in colour, lasts for 29 minutes and is obtainable on free loan on request from the publicity department of the company.

Prolite Standard Tools

Some adjustments to the cost of "Prolite" standard tungsten carbide tipped tools are being made by **Protolite Limited.** The changes do not involve a general increase in charges for the tools but rather

reflect the alterations necessary to restore a reasonable balance between cost of manufacture and selling price. Some tools are dearer, some remain at the current level and some have been reduced. The new prices came into effect for orders received on and after July 24.

Guide to Arc Welding

A new publication — The AEI Arc Welding Guide— has recently been issued by **Associated Electrical Industries Ltd.** It replaces previous Metrovick electrode guides.

In addition to the latest data on the wide range of AEI welding electrodes, this enlarged booklet contains a considerable amount of technical information on welding, providing a comprehensive guide for the welding fabricator.

Included in the new sections are a complete list of British Standard specifications relating to welding processes and applications, notes on the care of electrodes, and a brief list of AEI arc-welding plant.

American Competition

Stated to have been built at considerably less cost than prices submitted by American competitors, a 40 ft. long, 11 ft. high and 14 ft. wide furnace has this week been despatched to Slough, Bucks., by the Birmingham firm of **J.L.S. Engineering Company Ltd.**

The furnace, which has been ordered by Southern Forge Limited and can deal with 12 tons of aluminium ingots at one time, has taken some four months to build at a cost of about £8,000.

A Feature Film

A second edition of "Hard Metal", a feature film on manufacture and applications, has been produced to replace the original film presented by **Murex Limited** in 1950. The film, shot at the Rainham works of the company, shows in great detail the whole manufacturing process, from the treatment of wolfram and scheelite ores to the production of tungsten carbide tips, tools and dies.

The opening sequences indicate the wide field of application for this important material in modern tooling, and then the progress of the ore concentrates is followed through a number of large chemical plants. After the chemical sections, and starting with the reduction of pure tungstic acid, every stage in the manufacture of cemented tungsten carbide is shown and described.

To illustrate each phase of the complex processes involved, diagrams appear at intervals throughout the film. In the fabricating plants, the various machines and methods used to produce the finished tools and dies are shown, and, in conclusion, tungsten carbide tooling can be seen at work in industry. The total running time of the film is approximately 50 min.

Air Plug Gauges

A new, low-priced type of air plug gauge known as "Hardcoat" plugs has recently been introduced by **Teddington Industrial Equipment Ltd.** These plugs are made of aluminium specially processed to have a very hard surface. This, together with a large wear allowance, gives the plugs a tough, thick wear surface, ensuring an exceptionally long life.

These plugs have been given exhaustive laboratory tests and field trials under very severe conditions. They are also light in weight. Through and blind hole forms are available for all sizes larger than 0·4 in. and for holes of any depth.

Norwegian Aluminium Plant

It is reported from Oslo that Elektrokemisk A/S is planning to build a new aluminium plant, according to Mr. Karl Lorck, a director. Mr. Lorck told the Norwegian news agency NTE recently that his firm had been studying the prospects of securing the necessary electric power from the Sira and Kvina river systems in the county of West Agder. Lista, on the southern tip of Norway, was being seriously considered as a site for the new plant, he said.

Malaya and Buffer Pool

According to news from Kuala Lumpur, the Malayan Government has begun paying back to the tin industry 55·4 million dollars contributed from 1957 to the first buffer stock of the International Tin Council. The miners will get back in a lump sum a full refund of their contributions. Mining sources here believe that a substantial portion of the refund as far as Chinese miners in Malaya are concerned will go to settle outstanding accounts and open marginal mines. The Government announced that the first contributions towards the Tin Council's second buffer stock will be collected from August 1.

New Machinery Catalogue

Published twice yearly by **Thos. W. Ward Limited,** a new machinery catalogue has just made its appearance and covers seven sections dealing with the company's comprehensive stocks of new, reconditioned and secondhand machinery and machine tools.

These sections describe machine tools, sheet metal working machinery, woodworking machinery, small tools, power plant, metal working machinery, foundry and forge plant, and electrical plant. The catalogue also lists availabilities at each of the company's four machinery showrooms—at Sheffield, London, Glasgow and Briton Ferry—all of which can call, when necessary, on the full resources of other showrooms. The Ward group of interests covers hydraulic presses and accessories, air compressors, welding plant, wire drawing machinery, castings, non-ferrous metals, and scrap metals.

Aluminium for Hulls

An aircraft firm in Toronto, Canada—the Avro Aircraft Ltd. — is reported to be manufacturing a new type of aluminium planked hull for Richardson boats, a U.S.A. line of pleasure cruisers, ranging in length from 28 ft. to 46 ft. The planked construction provides the appearance of conventional wooden craft but adds the advantages of light weight and minimum maintenance derived from aluminium.

Ambuco Exhibits

At the Heating, Engineering, Ventilating and Air Conditioning Exhibition, to be held at Olympia, London, from September 26 to October 6 next, **Ambuco Limited** (who are members of the Gold Fields Mining and Industrial Group) will be showing working demonstrations of two novel dust control processes.

The first concerns Ambuco Venturi Scrubbers, which are made under licence from Waagner-Biro of Austria. In this instance, a Perspex model will show in detail how dust-laden fumes are drawn through a double cone of water at the head of the venturi. This technique, which can be applied to a wide variety of industrial processes, ranging from metal refining to chemical manufacture, ensures as high an efficiency as 99·6 per cent for the removal of entrained solids in the particle size range 5 to 0·01 microns.

The other demonstration, again using a Perspex model, shows the operation of Ambuco guaranteed efficiency cyclones. which feature a "shave off" port ensuring a higher than average efficiency.

Chilean Copper Output

A Bill compelling the big American copper companies in Chile to increase their output by a minimum of 15 per cent every three years will be submitted to Congress by the Chilean Government. This was announced by the Minister for Mines, Senor Enrique Serrano. He said the 15 per cent accumulative increase would be based on average output during the previous five years. The Bill also urges that the largest possible amount of copper ore mined in Chile should also be refined there.

The Chilean Government would endeavour to expand exports as much as possible, looking for markets now closed to Chilean copper. Senor Serrano said the Chilean Government had handed a memorandum to Mr. Adlai Stevenson during his recent visit demanding U.S. Government co-operation in promoting the stability of world copper prices. He added that the Chilean Government would be pleased if foreign copper companies working in Chile decided to become incorporated in Chile instead of working as subsidiaries of the foreign companies.

Delta and Coventry Cathedral

Some of the final sections for the giant-sized Coventry Cathedral Great West

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Screen were delivered last week and comprised a special long lorry load of 60 ft. Delta bronze stressing rods, which will be fixed across the centre of the screen and up to the lofty ceiling on each side.

The entire frame, which measures 70 ft. high by 51 ft. wide, has been constructed in Delta bronze by the Crittall Manufacturing Company Limited, and the stressing rods were extruded and delivered by the **Delta Metal Company Limited.**

Price Reduction

An announcement from **Honeywell Controls Ltd.** concerned a reduction in price of the Honeywell Ultra-Vision flame detector, the price of which has now been reduced from £66 11s. 0d. to £45 (list) as a result of increased acceptance of the unit in the United Kingdom.

The Ultra-Vision detector, described by the company as a dramatic breakthrough in combustion safeguards, is generally used in conjunction with a flame failure relay. It is a "foolproof" safety device for furnaces, ovens, etc., because it senses only the ultra violet radiation in a flame, and ignores refractory radiation and other simulated flame conditions.

Aluminium for Architects

On Tuesday of last week, at a large gathering of leading architects and representatives of the various sections of the building industry in the London region, **The British Aluminium Company Limited** introduced its new "British Aluminium Building Service", which represents a major step forward in the bringing together of the suppliers and manufacturers of aluminium products and the end-users of those products.

Sir William Strath, K.C.B., managing director of the company, who welcomed the architects on their arrival at the meeting, remarked, in introducing this new service, that it was appropriate that so soon after the Congress of the International Union of Architects, the headquarters building used by that Congress on the South Bank of the Thames should be the venue for launching a major scheme to enable British architects to make the fullest possible use of one of the "new materials and techniques", namely, aluminium.

The manager primarily responsible for the planning of the service, **Mr. Neill Newsum,** explained its operation and introduced **Mr. Eric Bird,** M.B.E., M.C., A.R.I.B.A., technical and research officer at the Building Centre, who commented on this new project from the user's point of view. In paying tribute to **Mr. Bruce Martin,** A.R.I.B.A., whose advice had been widely sought and taken, especially in compiling the special documentation, Mr. Newsum stressed that the British Aluminium Building Service had been planned and executed to a large extent by architects for architects.

The sponsors of this scheme have analysed the needs of the architectural profession and tried so to organize their service that it will provide the maximum possible aid to each individual architect and, in particular, to provide in a simple and direct manner, the information he needs to obtain the right product or material for his designs. In effect, the result has been a co-ordination and correlation of a large mass of separate pieces of information in a single comprehensive manual, appropriately entitled "Aluminium for Architects". One copy of this book is being supplied free of charge to every architectural practice in the United Kingdom, and will be maintained constantly up-to-date as new developments occur in the future.

This manual, although the most "visible" aspect of the British Aluminium Building Service, is, however, only the first part of it, for a comprehensive follow-up information service, organized on a regional basis, and in the closest collaboration with all the fabricators of aluminium building products, is provided. The information service is staffed by specialists and is available at all times to give further advice and help to architects and users of those products.

Visiting North America

Because the Canadian and United States automobile industry offers a vast sales potential for a Bilston product, Mr. Gerald Hewitt, sales supervisor for **Plastics and Resins Limited,** is to visit Montreal and Detroit. This visit will be the first development in the company's plan to establish their "Metolux" cold casting metal filler product in these two countries.

The filler is used mainly for car body repairs and is a liquid consisting of thermosetting plastics and a separate metallic powder which combine to form a mouldable paste. It is said to set as hard as solid metal.

Aluminium in France

According to trade sources in Paris, French aluminium production in the first half of 1960 rose to 131,381 tons, from 106,870 in the corresponding period of last year. The 24 per cent increase is accounted for largely by the start of operations at a new potline at Pechiney's Nogueres aluminium plant. In addition, the French share of Cameroun aluminium production rose to 17,830 tons from 17,000 in the first half of 1960.

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for May 1961 have been issued by the Aluminium Industry Council as follows (in long tons):—

Virgin Aluminium	
Production	2,921
Imports	23,566
Despatches to consumers	26,011
Secondary Aluminium	
Production	10,699
Virgin content of above	1,165
Despatches (including virgin content)	11,157
Scrap	
Arisings	12,850
Estimated quantity of metal recoverable	9,445
Consumption by:	
(a) Secondary smelters	11,737
(b) Other uses	877
Despatches of wrought and cast products	
Sheet, strip and circles	14,604
Extrusions (excluding forging bar, wire-drawing rod and tube shell):	
(a) Bars and sections	3,931
(b) Tubes (i) extruded	413
(ii) cold drawn	591
(iii) formed strip	—
(c) (i) Wire	1,839
(ii) Hot rolled rod (not included in (c) (i))	37
Forgings	365
Castings: (a) Sand	1,721
(b) Gravity die	4,428
(c) Pressure die	2,189
Foil	2,243
Paste	327

LIGHT METALS STATISTICS IN JAPAN
(January 1961)

Classification	Production	Shipment	Stock	Export
Alumina	30,486	35,817	15,423	13,863
Super purity Al	133	122	672	0
Primary Al	11,981	12,657	5,877	0
Secondary Al	4,946	4,934	870	0
Wrought products (Al and its alloy)	11,950	11,965	3,820	992
Plate, sheet and strip	8,100	8,188	2,544	763
Foil	791	843	270	
Rolled and extruded shape	2,035	1,979	324	
Forgings	31	—	—	—
Electric wire	990	955	682	229
Powder, flake and paste	—	—	—	—
Casting	5,841	—	—	—
Sand and permanent mould	3,038	—	—	—
Die	2,803	—	—	—
Sheet products	2,386	2,378	1,387	44
Primary Mg	236	197	44	—
Secondary Mg	246	245	429	—
Mg casting	30	—	—	—
Sponge Ti	197	182	1,014	169
Super purity Al (Feb.)	108	91	689	—
Primary Al (Feb.)	10,686	11,844	4,719	0

Company Reports

Expandite Ltd.

Final dividend 6¾ per cent, making 10 per cent year to April 1, 1961 (same equivalent). Group profit £130,019 (£126,582), after tax of £142,180 (£133,264), etc., attributable to holding company £109,848 (£120,494). Forward £216,799 (£167,404).

Efco Ltd.

Group net profit year ended March 31, 1961, £156,463 (£152,890), after tax £166,442 (£136,991). Attributable to outside shareholders £207 (debit £137). To Preference dividend £5,237 (same), Ordinary dividend, as known equivalent to 11¼ per cent £57,515 (10 per cent equivalent £51,123), general reserve £100,000, written off goodwill and patents £94,202, forward £44,438 (£45,755), including tax credits £5,197 (£2,304).

Murex Ltd.

Accounts show net profit at £691,000. Board recommends a final dividend of 8 per cent, making 13 per cent for the year on the increased capital.

Metal Market News

THE Copper Institute figures for June were published in the early part of last week, and the details in short tons of 2,000 lb. are as follows. Inside the United States, production of crude copper was 112,999 tons, compared with 116,703 tons in May, while the output of refined copper dropped from 148,961 tons in May to 141,140 tons in June. Deliveries to consumers at 139,700 tons were nearly 8,000 tons up but stocks of refined copper in producers' hands registered a noteworthy decline from 106,982 tons to 890,008 tons. Outside the United States, stocks dropped from 322,341 tons at May 31 to 314,051 tons at June 30, so that the reduction in refined copper stocks on a world basis amounted to about 26,000 short tons. Production of crude copper in countries other than the United States totalled 198,128 tons, a drop of 2,050 tons, while the output of refined metal, at 166,319 tons, was lower by about 3,200 tons. Deliveries, too, were lower, for the June figure of 197,847 tons compared with 208,516 tons in May. These figures are decidedly bullish, for the copper quotation and the market this week has displayed optimism, although, on the whole, the trend has been undecided. Business is exceedingly quiet, and this must be ascribed partly to holiday influences and partly to apprehension, which has been engendered by the expectation of Governmental action in connection with the country's economic plight.

The usual details of Metal Exchange stocks were issued at the beginning of last week, the advance of no more than 100 tons in standard copper being the smallest seen since early June. The total built up to 19,977 tons, but it is generally expected to go higher. Tin stocks, as anticipated, declined, as indeed they have been doing since the beginning of April, the loss on the week amounting to 305 tons, bringing the reserve down to 6,485 tons. In lead, the previous tonnage of 12,883 was increased to 13,068 tons, a gain of 185 tons on the week, while in zinc there was a rise of 83 tons to 6,809 tons. Many works will be closing down today for a couple of weeks, in line with the usual holiday arrangements, while some may be suspending operations in a week's time. Till the second half of August, therefore, we can hardly expect much improvement in buying by consumers.

During the second half of the week, and particularly on Thursday and Friday, the copper price improved and closed at the highest point for the week. During the course of trading, which amounted to some 13,500 tons, the contango in standard copper narrowed from £4 5s. 0d. to £2 15s. 0d., a somewhat inexplicable development as there is no question, so far as is known, of stocks being drawn upon. Finally, cash closed £4 15s. 0d. up at £232 10s. 0d., while three months gained £3 5s. 0d. at £235 5s. 0d. It has been suggested that American buying may have been responsible for the strength of the cash quotation. Tin lost 30s., both positions, on a turnover of 1,155 tons, to close at £910 10s. 0d. cash and £922 three months. On a turnover of 6,250 tons, lead closed about 10s. higher at £65 10s. 0d. and £66 12s. 6d. Zinc was 20s. up for cash at £78 15s. 0d., and 22s. 6d. up three months at £80. The turnover was 5,725 tons.

New York

Copper futures regained small early losses in slow dealings earlier this week which, brokers said, reflected strike threats in Chile and in the U.S. In the physical market, dealers reported quiet conditions. Meanwhile, custom smelters reported satisfactory demand at the 31·00 cent level. Large producers booked routine orders. Scrap copper was steady. Lead was quiet. Zinc was described as slightly more active than on Friday. Tin prices eased on lower Far East advices, together with slow domestic demand. In late dealings, all metals were quiet.

The statistical working group on lead and zinc is scheduled to meet in Geneva on October 17 and 18. The full international lead-zinc study group is scheduled to meet in Geneva from October 23-27.

It was announced by the General Services Administration in Washington last week that it would dispose of 500 long tons of pig tin from the inventory formerly held in the Federal Facilities Corporation. This tin is not in the national stockpile and is in excess of the needs of the Government. The tin offered for sale is the "longhorn" brand of pig tin, refined in Texas and stored at Wardwell, Ohio, close to consuming centres in the Cleveland, Youngstown, Wheeling and Pittsburgh areas.

G.S.A. said the tin would be offered for sale in 50 lots of ten tons each, consisting of 40 lots of Grade A, five lots of Grade B and five lots of Grade C. All the pig tin meets the stockpile specification for these grades.

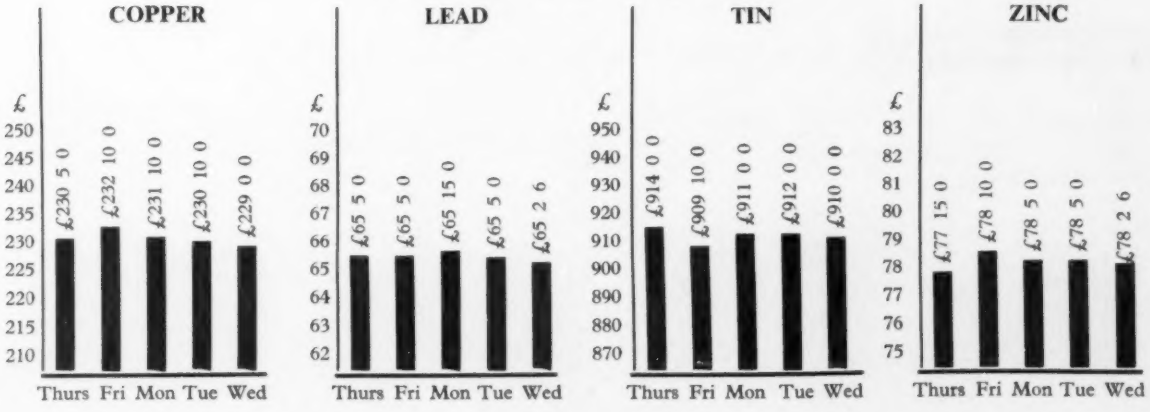
Paris

The French Government has announced the opening of global import quotas applicable to all countries with which the franc is freely convertible, with the exception of Albania, Egypt, Poland and the Soviet Union.

The quotas—valid under the import programme for the second half of 1961—refer to products for which quantitative restrictions have not yet been removed. They include: various agricultural products, various oil products; non-ferrous ores and scrap; basic ingredients of pharmaceuticals and antibiotics.

London Metal Exchange

Thursday 20 July to Wednesday 26 July 1961



NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 26/7/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	237	10	0
Antimony Metal 99%	,,	230	0	0
Antimony Oxide Commercial	,,	194	10	0
Antimony White Oxide	,,	212	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite per unit			8	10	0
Copper H.C. Electro	ton	229	0	0
Fire Refined 99·70%	,,	228	0	0
Fire Refined 99·50%	,,	227	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	12	2¼
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	65	2	6
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9+%	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4	,,		5	6
Alloy Ingot, AZ91X		1	11½-2	1½
Manganese Metal	ton	280	0	0
Mercury	flask	66	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	,,		5	11
Osmium	oz.	20	0	0
Osmiridium	,,		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	7⅛
Tellurium Sticks	lb.	2	0	0
Tin	ton	910	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	,,		—	
Virgin Min 98%	,,	78	12	6
Dust 95/97%	,,	121	10	0
Dust 98/99%	,,	128	10	0
Granulated 99+%	,,	103	12	6
Granulated 99·99+%	,,	116	1	3

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 26/7/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	210	0	0
B.S. 1490 L.M.6 ,,	202	0	0
B.S. 1490 L.M.7 ,,	216	0	0
B.S. 1490 L.M.8 ,,	203	0	0
B.S. 1490 L.M.9 ,,	203	0	0
B.S. 1490 L.M.10 ,,	221	0	0
B.S. 1490 L.M.11 ,,	215	0	0
B.S. 1490 L.M.12 ,,	223	0	0
B.S. 1490 L.M.13 ,,	216	0	0
B.S. 1490 L.M.14 ,,	224	0	0
B.S. 1490 L.M.15 ,,	210	0	0
B.S. 1490 L.M.16 ,,	206	0	0
B.S. 1490 L.M.18 ,,	203	0	0
B.S. 1490 L.M.22 ,,	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	155	0	0
B.S. 1490 L.M.2 ,,	153	0	0
B.S. 1490 L.M.4 ,,	163	0	0
B.S. 1490 L.M.6 ,,	176	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	243	0	0
BSS 1400 AB.2 ,,	251	0	0

***Brass**	£	s.	d.
BSS 1400-B3 65/35 ton	177	0	0
BSS 249 ,,		—	
BSS 1400-B6 85/15 ,,	222	0	0
***Gunmetal**			
R.C.H. 3/4% ton ,,		—	
(85/5/5/5) LG2 ,,	219	0	0
(86/7/5/2) LG3 ,,	229	0	0
(88/10/2/1) ,,	288	0	0
(88/10/2/½) ,,	298	0	0
***Manganese Bronze**			
BSS 1400 HTB1 ,,	195	0	0
BSS 1400 HTB2 ,,	216	0	0
BSS 1400 HTB3 ,,	231	0	0
Nickel Silver			
Casting Quality 12% ,,	260	0	0
,, ,, 16% ,,	270	0	0
,, ,, 18% ,,	310	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) ,,	315	0	0
B.S. 1400 L.P.B.1 ,,	241	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	257	0	0
15% ,,	260	0	0
Phosphor Tin			
5% ,,	989	0	0
Silicon Bronze			
BSS 1400-SB1 ,,	290	0	0
Solder, soft, BSS 219			
Grade C Tinmans ,,	413	10	0
Grade D Plumbers ,,	328	10	0
Grade M ,,	456	5	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 ,, ,,		—	
Zinc Alloys			
BSS 1004 Alloy A ton	109	11	3
BSS 1004 Alloy B ,,	113	11	3
Sodium-Zinc lb.		2	6½

SCRAP METALS

Merchants' average buying prices delivered, per ton, 25/7/61

Aluminium	£
New Cuttings	136
Old Rolled	102
Segregated Turnings	77
Brass	
Cuttings	160
Rod Ends	144
Heavy Yellow	137
Light	132
Rolled	147
Collected Scrap	134
Turnings	137

Copper	£
Wire	206
Firebox, cut up	204
Heavy	203
Light	200
Cuttings	211
Turnings	187
Braziery	168
Gunmetal	
Gear Wheels	198
Admiralty	198
Commercial	180
Turnings	175

Lead	£
Scrap	55
Nickel	
Cuttings	—
Anodes	591
Phosphor Bronze	
Scrap	180
Turnings	175
Zinc	
Remelted	70
Cuttings	64
Old Zinc	42

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

		£ s. d.
Aluminium		
Sheet 10 S.W.G.	lb.	2 10½
Sheet 18 S.W.G.	,,	3 0½
Sheet 24 S.W.G.	,,	3 3½
Strip 10 S.W.G.	,,	2 10½
Strip 18 S.W.G.	,,	2 11½
Strip 24 S.W.G.	,,	3 1
Circles 22 S.W.G.	,,	3 4½
Circles 18 S.W.G.	,,	3 3½
Circles 12 S.W.G.	,,	3 2½
Plate as rolled	,,	2 10
Sections	,,	3 4
Wire 10 S.W.G.	,,	3 1½
Tubes 1 in. o.d. 16 S.W.G.	,,	4 4
Aluminium Alloys		
BS 1470. HS19W.		
Sheet 10 S.W.G.	,,	3 3
Sheet 18 S.W.G.	,,	3 5½
Sheet 24 S.W.G.	,,	4 1
Strip 10 S.W.G.	,,	3 3
Strip 18 S.W.G.	,,	3 4½
Strip 24 S.W.G.	,,	4 0½
BS1477. HP30M.		
Plate as rolled	,,	3 1
BS1470. HC15WP.		
Sheet 10 S.W.G.	,,	4 3
Sheet 18 S.W.G.	,,	4 8½
Sheet 24 S.W.G.	,,	5 8½
Strip 10 S.W.G.	,,	4 4
Strip 18 S.W.G.	,,	4 8½
Strip 24 S.W.G.	,,	5 4½

		£ s. d.
Aluminium Alloys—cont.		
BS1477. HPC15WP.		
Plate heat treated	lb.	3 10½
BS1475. HG19W.		
Wire 10 S.W.G.	,,	4 2
BS1471. HT19WP.		
Tubes 1 in. o.d. 16 S.W.G.	,,	5 5
BS1476. HE19WP.		
Sections	,,	3 4
Split tube		
19 S.W.G. (¼″)	,,	4 2
20 S.W.G. (⅜″)	,,	3 11
21 S.W.G. (⅜″)	,,	4 1
22 S.W.G. (¼″)	,,	4 11
Welded tube 14 to 20 S.W.G. (sizes ½″ to 1½″)	,,	3/10½ to 5/8½
Brass		
Tubes	lb.	1 9¾
Brazed Tubes	,,	3 2¾
Drawn Strip Sections	,,	3 2¾
Sheet	ton	198 15 0
Strip	,,	198 15 0
Extruded Bar	lb.	2 0¾
Condenser Plate (Yellow Metal)	ton	186 0 0
Condenser Plate (Naval Brass)	,,	199 0 0
Wire	lb.	2 8½

		£ s. d.
Beryllium Copper		
Strip	lb.	1 4 11
Rod	,,	1 1 6
Wire	,,	1 4 9
Copper		
Tubes	lb.	2 3¾
Sheet	ton	264 15 0
Strip	,,	264 15 0
H.C. Wire	,,	283 15 0
Cupro Nickel		
Tubes 70/30	lb.	3 8¾
Lead		
Pipes (London)	ton	107 0 0
Sheet (London)	,,	104 15 0
Tellurium Lead	,,	£6 extra
Nickel Silver		
Sheet and Strip 10%	lb.	3 11½
Wire 10%	,,	4 4½
Phosphor Bronze		
Wire	,,	4 1¾
Titanium (1,000 lb. lots)		
Billet 4½″ to 18″ dia.	lb.	47/- 48/-
Rod ¼″ to 4″ dia.	,,	85/- 53/-
Wire ·036″-232″ dia.	,,	159/- 99/-
Strip ·001″ to ·048″	,,	350/- 68/-
Sheet 8′ × 2′. 20 gauge	,,	73/-
Tube, representative average gauge	,,	198/-
Extrusions	,,	90/-
Zinc		
Sheet	ton	116 15 0
Strip	,,	nom.

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	126.73	926 8

Canada	c/lb	£/ton
Aluminium	26.00	210 12
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.35	1,208 5
Copper: electrolytic	3.19	235 14
Lead	.95	70 4
Nickel	9.00	665 2
Tin	12.92	954 15
Zinc: Thermic	1.14	84 4
Zinc: electrolytic	1.22	90 3
Scrap		
Copper: electrolytic	2.85	210 12
Heavy copper	2.85	210 12
No. 1 copper wire	2.70	199 10
Brass rod ends	2.10	155 3
Zinc castings	.90	66 10
Lead	.87	64 5
Aluminium	1.75	129 6

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	485	283 4
Copper: wire bars 99.9	450	262 16
Lead	164	96 15
Nickel	1,300	805 14
Tin	1,750	1,022 0
Zinc: electrolytic	180	105 2
Scrap		
Aluminium soft sheet clippings (new)	305	178 2
Lead, soft, first quality	137	80 0
Lead, battery plates	77	45 19
Copper, first grade	375	219 0
Bronze, commercial gunmetal	410	239 8
Brass: heavy	275	160 12
Brass: light	260	152 16
Brass, bar turnings	275	160 12
Old zinc	105	61 6

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.88	242 4
Lead	.82	68 19
Nickel	7.50	630 15
Tin	11.25	946 2
Zinc: High grade 99.99	1.06	89 2

Japan Yen per metric ton	
Scrap	
Copper: electrolytic	298,000
Copper wire No. 1	272,000
Copper wire No. 2	268,000
Heavy copper	262,000
Light copper	237,000
Brass, new cuttings	203,000
Red brass scrap	215,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	220	200 8
Heavy copper	220	200 8
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	105	95 13
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	75	68 6

United States	c/lb	£/ton
Aluminium	26.00	207 4
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	115.62	921 9
Zinc: electrolytic	12.50	99 12

THE STOCK EXCHANGE

A Recovery Got Under Way

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 24 JULY	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	32/–		11	9	6 17 6	33/9	26/3	35/–	26/6
400,000	2/–	Anti-Attrition Metal	1/3		NIL	4	NIL	1/3‡	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries ...	39/6	+1/9	15	15	7 15 9	54/10½	36/6	67/3	38/3
3,895,963	1	Birfield	60/6	+3/–	10	15‡	3 6 0	78/9	45/–	51/3	29/–
4,795,000	1	Birmid Industries	76/6	—1/6	20	20D	5 4 6	103/–	71/3	74/9	56/–
8,445,516	Stk (10/–)	Birmingham Small Arms	23/–	+2/–	17½QT	12½	5 1 6	36/10½	21/–	30/6	18/3
203,150	Stk (£1)	Ditto Cum. A. Pref. 5%	14/–		5	5	7 2 9	14/6	13/1½	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6		6	6	7 5 6	17/6	16/4½	20/–	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	15/9		6	6	7 12 6	18/–	15/4½	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	57/–	+1/6	13½	13½	4 14 9	62/3	49/–	61/4½	47/–
20,456,599	5/–	British Oxygen Co. Ltd., Ord. ...	21/–	+9d.	16D	16	2 10 9	29/4½	17/6	35/–	19/10½
1,200,000	Stk. (5/–)	Canning (W.) & Co.	16/–	+1/–	15⅝	25+•2½C‡	4 9 0	20/9	13/7½	19/9	13/7½
60,484	1/–	Carr (Chas.)	1/1½		NIL	12½	—	1/7½	10½d.	2/3	1/–
555,000	1	Clifford (Chas.) Ltd.	31/–		12	10	7 14 9	31/–	26/–	35/–	28/9
45,000	1	Ditto Cum. Pref. 6%	15/–		6	6	8 0 0	15/3	15/–	16/–	15/10½
300,000	2/–	Coley Metals	3/3		15	15	9 4 6	4/5½	3/–	5/–	3/4½
10,185,696	1	Cons. Zinc Corp.†	64/9	+9d.	20	15	6 3 6	81/6	63/–	80/9	59/6
5,399,056	1	Davy-Ashmore	142/6	+2/6	27½	22½	3 17 3	177/6	129/6	147/3	99/6
8,000,000	5/–	Delta Metal	22/9	+2/6	20	17½	4 8 0	27/7½	19/9	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	39/6		15	15	7 12 0	52/3	39/–	56/9	45/–
1,155,000	1	Evered & Co.	44/–		10	10φB	4 11 0	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	30/9	—6d.	10	10	6 10 0	39/6	29/–	47/9	29/–
1,500,000	Stk. (10/–)	General Refractories Ltd.	57/–	—1/–	25	20	4 7 9	65/–	42/9	52/6	40/–
937,500	5/–	Glacier Metal Co. Ltd.	18/3	+3d.	15	13	3 18 0	21/1½	13/9	16/1½	11/1½
2,500,000	5/–	Glynwed Tubes	24/3	+9d.	22½	25¶	4 12 9	30/3	23/–	27/6	17/–
7,228,065	10/–	Goodlass Wall & Lead Industries ...	34/6	+1/6	15	19L	4 7 0	44/9	32/6	41/9	33/–
696,780	10/–	Greenwood & Batley	20/6		15	30‡	7 6 3	29/6	20/6	33/6	29/1½
792,000	5/–	Harrison (B'ham) Ord.	10/9		•10	•20‡	4 13 0	14/6	10/9	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	19/9		7	7	7 1 9	20/4½	19/7½	23/6	22/–
1,612,750	5/–	Heenan Group	12/6		13	15	5 4 0	17/1½	10/6	13/–	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries ...	68/–	+3/–	13⅜	11⅛	4 0 9	81/6	63/1½	76/6	54/–
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/1⅛		5	5	7 1 6	16/–	13/10½	18/–	15/4½
29,196,118	••	International Nickel	153½	+4½	$1.60	$1.50	1 16 0	152½	104	105	84⅜
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/–		5	5	7 2 9	14/10½	13/6	16/6	14/6
6,000,000	1	Ditto Ord.	71/–	+9d.	15	12	4 4 6	75/–	57/6	67/6	44/9
600,000	10/–	Keith, Blackman	19/–		17½	17½E	9 4 3	21/6	18/3	32/6	17/6
320,000	4/–	London Aluminium	12/3	—3d.	13	12	4 5 0	15/–	8/6	12/6	7/10½
765,012	1	McKechnie Bros. Ord.	40/6xcap	+6d.	12½K	17½F	6 3 6	53/6	35/4	71/6	57/3
1,530,024	1	Ditto A. Ord.	37/3xcap	—1/–	12½K	17½F	6 14 3	53/3	35/3	69/3	55/–
1,108,268	5/–	Manganese Bronze & Brass	13/6	—1/–	20⅝	20⅝	7 14 3	18/6	13/4½	18/6	13/4½
50,628	6/–	Ditto (7½% N.C. Pref.)	5/6		7½	7½	8 3 6	6/–	5/–	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	89/–	+6d.	12	12M	2 14 0	100/9	68/3	84/3	61/–
415,760	Stk. (2/–)	Metal Traders	7/9	+3d.	50	50	12 18 0	8/9	6/9	10/9	7/1½
160,000	1	Mint (The) Birmingham	51/6		15	12½	5 16 6	53/6	36/–	39/–	33/6
80,000	5	Ditto Pref. 6%	76/3		6	6	7 17 6	77/6	76/–	80/–	75/–
5,187,938	Stk. (£1)	Morgan Crucible A	55/3	—2/–	14	13	5 1 3	71/3	53/4½	63/–	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	14/6	—6d.	5½	5½	7 11 9	17/–	14/1½	18/9	15/9
3,850,000	Stk. (£1)	Murex	41/6	—1/3	13	22½J	6 5 3	52/–	39/9	45/–	35/3
585,000	5/–	Ratcliffs (Great Bridge) Ord. ...	16/3		10	10R	3 1 6	16/6	15/9	17/–	14/9
195,000	5/–	Ditto 8% Max. Ord.	5/–		8	—	8 0 0	5/1½	4/9	5/3	5/–
1,064,880	10/–	Sanderson Kayser	31/–	+1/–	17½	35‡	5 13 0	41/3	30/–	40/3	27/7½
3,400,500	Stk. (5/–)	Serck	15/6	+9d.	12½	17½GD	4 0 9	19/3	14/9	25/6	15/3
8,035,372	Stk. (£1)	Stone-Platt Industries	50/6	+6d.	16	15	6 6 9	67/–	50/–	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	13/9	—1/3	5½	5½	8 0 0	18/–	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	69/–	+1/9	14	20	4 1 3	85/6	67/–	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	33/3	+3/3	10	10	6 0 3	38/3	28/–	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	14/–		5	5	7 2 9	15/–	12,7½	17/6	13/3
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7,109,424	Stk. (£1)	Westinghouse Brake	34/9	—1/–	11	10	6 6 6	46/3	33/9	60/6	37/6
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591,000	5/–	Wolverhampton Metal	22/9	+3d.	32½	32½	7 2 9	30/–	22/6	39/9	23/9
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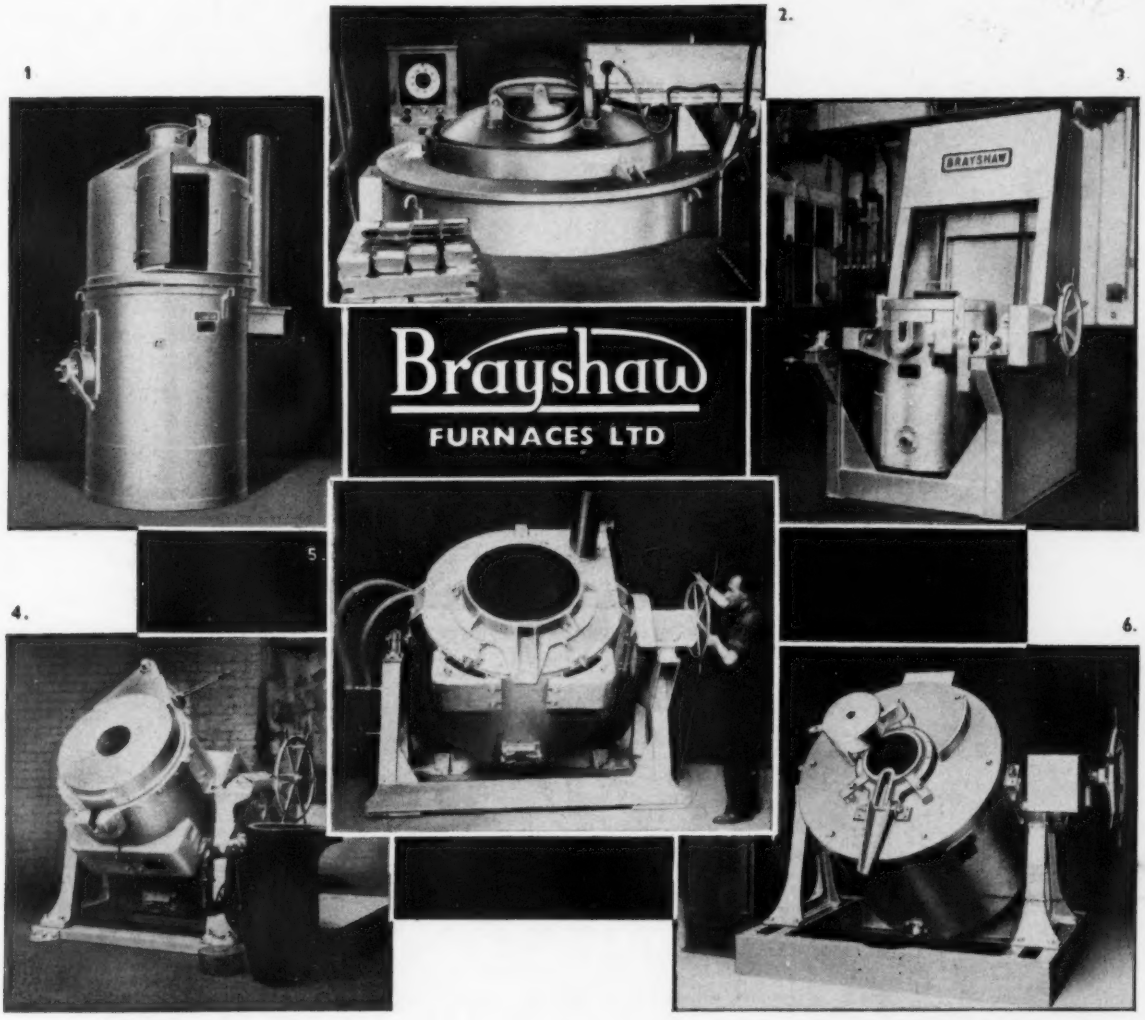

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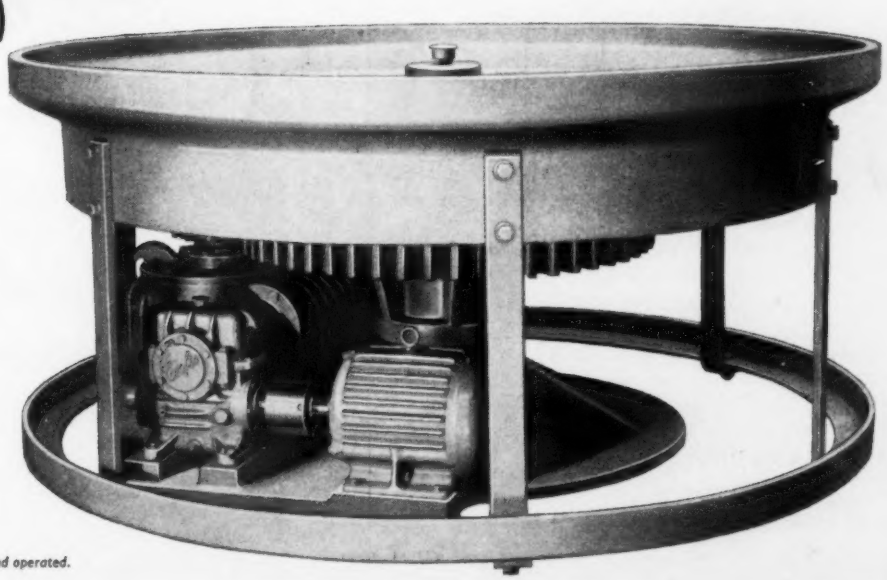

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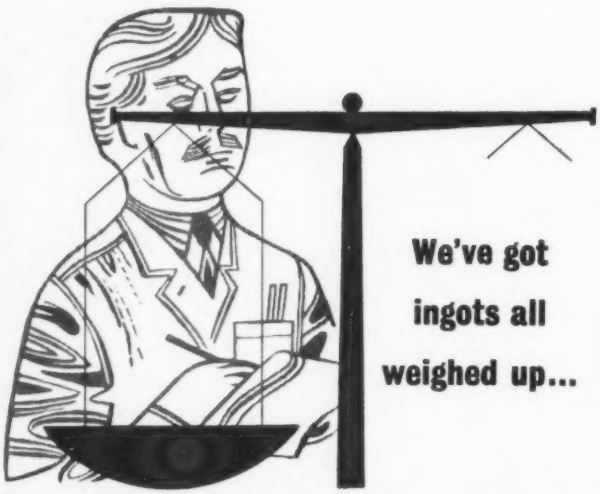

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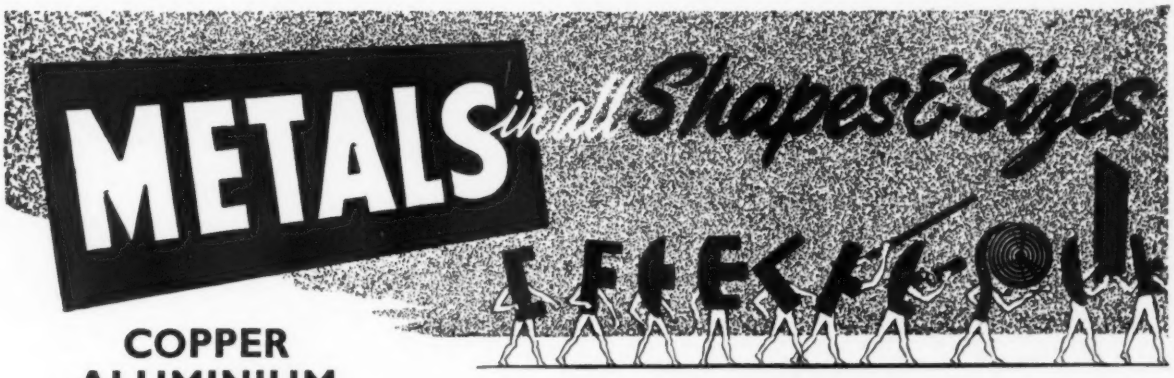

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These illustrations are taken from the latest Intal booklet, giving much interesting information on alloy ingot manufacture. We shall be pleased to post a copy to executives on request.

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